NON-CONFIDENTIAL
Nos. 2014-1437, 2014-1485

**UNITED STATES COURT OF APPEALS
FOR THE FEDERAL CIRCUIT**

Wi-LAN INC.,
Plaintiff-Appellant,

v.

APPLE INC.,
Defendant-Cross Appellant,

Appeals from the United States Court for the Eastern District of Texas in Case Nos. 2:11-CV-68, 2:12-CV-600, Honorable Judge Rodney Gilstrap.

OPENING BRIEF FOR PLAINTIFF-APPELLANT WI-LAN INC.

Robert A. Cote
MCKOOL SMITH P.C.
One Bryant Park, 47th Floor
New York, New York 10036
(212) 402-9400

Samuel F. Baxter
MCKOOL SMITH P.C.
104 E. Houston Street, Suite 300
P.O. Box O
Marshall, TX 75670
(903) 923-9000

Rosemary Snider
R. Darryl Burke
Seth Hasenour
MCKOOL SMITH P.C.
300 Crescent Court, Suite 1500
Dallas, TX 78201
(214) 978-4000

Dirk D. Thomas
MCKOOL SMITH P.C.
1999 K Street, Suite 600
Washington, DC 20006
(202) 370-8302

Attorneys for Plaintiff-Appellant Wi-LAN INC.

August 29, 2014

CERTIFICATE OF INTEREST

Counsel for Plaintiff-Appellant Wi-LAN Inc. certifies the following:

1. The full name of every party represented by me is:

   Wi-LAN Inc.

2. The name of the real party in interest represented by me is:

   None.

3. All parent corporations and any publicly held companies that own 10 percent or more of the stock of the party represented by me is:

   None.

4. The names of all law firms and the partners or associates that appeared for the party represented by me in the trial court or are expected to appear in this Court are:

   McKOOL SMITH P.C.

   Sam Baxter
   Robert Cote
   R. Darryl Burke
   Rosemary Snider
   Dirk Thomas
   Brett Cooper
   Laura Handley
   Seth Hasenour
   Kevin Schubert
   Jennifer Truelove
   Jonathan Yim

Dated: August 29, 2014.

Respectfully submitted,

/s/ Robert A. Cote
Robert A. Cote
MCKOOL SMITH P.C.
1 Bryant Park
New York, NY 10036
(212) 402-9402

Attorney for Wi-LAN Inc.

CONFIDENTIAL MATERIAL IS REDATED IN THIS BRIEF AT PAGES 25, 26, 27, 38, 53, 60 AND 61 CONSISTING OF TRADE SECRET INFORMATION REGARDING MICROCHIPS AND DESCRIPTIONS OF INFORMATION REGARDING TRADE SECRETS IN DOCUMENTS FILED UNDER SEAL AND PROTECTED UNDER THE PROTECTIVE ORDERS ENTERED BY THE DISTRICT COURT OF THE EASTERN DISTRICT OF TEXAS.

TABLE OF CONTENTS

Page

I. STATEMENT OF RELATED CASES 1

II. STATEMENT OF JURISDICTION 1

III. STATEMENT OF THE ISSUES 1

IV. STATEMENT OF THE CASE SETTING OUT THE FACTS 2

A. Wi-LAN Laid the Foundation for High-Speed Wireless Data Communications in Mobile Devices. 2

B. Wi-LAN Asserts Claims 1 and 10 of U.S. Patent No. RE37,802. 9

C. Claim Construction Issues Are Resurrected by Apple at Trial. 14

1. First Disputed Phrase: “converter for converting the first stream of data symbols into plural sets of N data symbols each.” 15

2. Second Disputed Phrase:“modulated data symbols.” 19

D. Apple Argued To The Jury That The ’802 Patent Was Limited to LANs and Excluded Cellular. 23

E. Wi-LAN Presented Unrebutted Infringement Evidence. 1

F. The Court Denied Wi-LAN’s Motion For JMOL on Infringement. 3

V. SUMMARY OF ARGUMENT 6

VI. ARGUMENT 10

A. Standards of Review..10

1. Standard of Review of a JMOL Decision. 10

2. Standard of Review for New Trial. 11

B. This Court Should Reverse the Denial of the JMOL and Find as a Matter of Law that Apple Infringes Claims 1 and 10 of the ’802 Patent. 12

1. Determinations of Claim Scope Are Not Jury Issues. 12

2. Apple Argued Claim Construction Issues to the Jury. 14

3. No Evidence Supports the Verdict of Non-Infringement under the Court’s Construction of a “Converter for Converting the First Stream of Data Symbols into Plural Sets of N Data Symbols Each.” 14

a. Wi-LAN Seeks Enforcement of the Jury Instruction on the “converter for converting . . .” Claim Element. 21

b. The Court Did Not Enforce the Jury Instruction for the “converter for converting . . .” Claim Element........23

4. No Evidence Supports the Verdict of Non-Infringement under the Court’s Construction of “Modulated Data Symbols.”...26

a. Wi-LAN Seeks to Enforce the Jury Instruction on the “modulated data symbols” Claim Element...............30

b. The Court Did Not Enforce the Jury Instruction for the “modulated data symbols” Claim Element...............32

c. Wi-LAN Proved Infringement Under the Doctrine of Equivalents. 34

C. Alternatively, A New Trial Should Be Granted..................................36

1. Apple’s Only Non-Infringement Defenses Were Contrary to the Court’s Claim Constructions and Jury Instructions........36

2. Apple Perniciously Argued That the ’802 Patent Was Not a Cellular Patent. 38

VII. CONCLUSION....................40

TABLE OF AUTHORITIES

Page(s)

CASES

Asyst Techs., Inc. v. Empak, Inc.,
268 F.3d 1364 (Fed. Cir. 2001) 52

Augustine Med., Inc. v. Gaymar Indus.,
181 F.3d 1291 (Fed. Cir. 1999) 2

Baldwin Graphics Sys., Inc. v. Siebert, Inc.,
512 F.3d 1338 (Fed. Cir. 2008) 57

Cybor Corp. v. FAS Technologies, Inc.,
138 F.3d 1448 (Fed. Cir. 1998) (en banc) 35

Cytologix Corp. v. Ventana Med. Sys., Inc.,
424 F.3d 1168 (Fed. Cir. 2005) 37, 62

Ford v. Cimarron Ins. Co.,
230 F.3d 828 (5th Cir. 2000) 35

Hewlett-Packard Co. v. Mustek Sys., Inc.,
340 F.3d 1314 (Fed. Cir. 2003) 48, 49

Honeywell Int'l Inc. v. Hamilton Sundstrand Corp.,
370 F.3d 1131 (Fed. Cir. 2004) 59

In re Teles AG Informationstechnologien,
747 F.3d 1357 (Fed. Cir. 2014) 53

Markman v. Westview Instruments, Inc.,
517 U.S. 370 (1996)....................37, 62

Markman v. Westview Instruments, Inc.,
52 F.3d 967 (Fed. Cir. 1995) (en banc) 35, 36

MBO Labs., Inc. v. Becton, Dickinson & Co.,
474 F.3d 1323 (Fed. Cir. 2007) 17

Moba, B.V. v. Diamond Automation, Inc.,
325 F.3d 1306 (Fed. Cir. 2003) ....passim

Nissho-Iwai Co. v. Occidental Crude Sales, Inc.,
729 F.2d 1530 (5th Cir. 1984) 36

O2 Micro Int'l Ltd. v. Beyond Innovation Tech. Co.,
521 F.3d 1351 (Fed. Cir. 2008) 37

Oak Tech., Inc. v. ITC,
248 F.3d 1316 (Fed. Cir. 2001) 52

Pitney Bowes, Inc., v. Hewlett-Packard Co.,
182 F.3d 1298 (Fed. Cir. 1999) 64

Rexnord Corp. v. Laitram Corp.,
274 F.3d 1336 (Fed. Cir. 2001) 55

Schindler Elevator Corp. v. Otis Elevator Co.,
593 F.3d 1275 (Fed. Cir. 2010) 35

Seachange Int'l Inc. v. C-COR Inc.,
413 F.3d 1361 (Fed. Cir. 2005) 35

Shows v. Jamison Bedding, Inc.,
671 F.2d 927 (5th Cir. 1982) 61

Smith v. Transworld Drilling Co.,
773 F.2d 610 (5th Cir. 1985) 36

Sundance, Inc. v. DeMonte Fabricating Ltd,
550 F.3d 1356 (Fed. Cir. 2008) 37, 62

Whitehead v. Food Max of Mississippi, Inc.,
163 F.3d 265 (5th Cir. 1998) 36, 63

STATUTES

28 U.S.C. § 1295(a) 1

28 U.S.C. §§ 1331 and 1338(a)..1

28 U.S.C. § 2107(a) 1

35 U.S.C. § 112, ¶ 6 52

RULES

FED. CIR. R. 47.5 1

FED. R. APP. P. 4(a) 1

FED. R. CIV. P. 50(b) 1

FED. R. CIV. P. 59 1

FED. R. CIV. P. 59(a)(1) 36

I. STATEMENT OF RELATED CASES

Pursuant to FED. CIR. R. 47.5, Plaintiff-Appellant Wi-LAN Inc. ("Wi-LAN") states that there have been no previous appeals in this case. Counsel for Wi-LAN are unaware of other pending cases in this Court that will be directly affected by, or that will directly affect, this Court's decision on the pending appeals, Nos. 2014-1437, 2014-1485.

II. STATEMENT OF JURISDICTION

The District Court for the Eastern District of Texas ("court") had jurisdiction over this action under 28 U.S.C. §§ 1331 and 1338(a). The Court of Appeals for the Federal Circuit has jurisdiction over this appeal under 28 U.S.C. § 1295(a). Wi-LAN timely filed its notice of appeal on April 18, 2014, under FED. R. APP. P. 4(a) and 28 U.S.C. § 2107(a). A252.

III. STATEMENT OF THE ISSUES

1. Whether the court erroneously denied Wi-LAN's JMOL motion for infringement under FED. R. CIV. P. 50(b) based on the "converter for converting . . ." claim element of asserted claims 1 and 10.

2. Whether the court erroneously denied Wi-LAN's JMOL motion for infringement under FED. R. CIV. P. 50(b) based on the "modulated data symbols" claim element of claims 1 and 10.

3. Whether the court erroneously denied Wi-LAN's alternative motion for a new trial under FED. R. CIV. P. 59 on the issue of infringement where Apple's

non-infringement defenses for claims 1 and 10 were based on adding limitations to the claim constructions for these two claim elements and for a third claim term "transceiver," which limitations were not included in the jury instructions, were rejected or omitted during *Markman*, and serve to limit the claims of Wi-LAN's pioneering wireless multiplexing technologies to a preferred embodiment.[1] Raising such claim construction issues at trial for resolution by the jury undermines the patent system and the rule of law upon which the country is founded.

IV. STATEMENT OF THE CASE SETTING OUT THE FACTS

A. Wi-LAN Laid the Foundation for High-Speed Wireless Data Communications in Mobile Devices.

Beginning in the early 1990s, Wi-LAN founders, Dr. Michel Fattouche[2] and Dr. Hatim Zaghloul,[3] developed and commercialized the fundamental technologies that enable high-speed wireless data communications in mobile devices. These

---

[1] *Augustine Med., Inc. v. Gaymar Indus.*, 181 F.3d 1291, 1301 (Fed. Cir. 1999) ("Pioneers enjoy the benefits of their contribution to the art in the form of broader claims.").

[2] Dr. Fattouche is on the Board of Directors of Wi-LAN. He is Professor of Electrical and Computer Engineering at the University of Calgary, and served 27 years as a professor. A788-A789. He holds bachelor degrees in electrical engineering and applied mathematics, and a master's and Ph.D. in electrical and computer engineering from the University of Toronto. A789.

[3] Dr. Zaghloul served as President and CEO of Wi-LAN until 2003 and was Chairman of the Board of Directors from 2003-2008. A810. He has a bachelor degree in engineering and a master's and Ph.D. in physics from the University of Calgary. A810, A3024.

technologies provide the desktop-like speeds necessary for mobile internet applications, such as sending email, streaming movies/videos/music, and sharing pictures to work from a smartphone or tablet computer. A789, A811-A813. The founders referred to these wireless capabilities at the time as "Network Living." A810-A813, A2984-A2987, A2959-A2962.

Early marketing materials illustrated Wi-LAN's Network Living vision and foreshadowed today's mobile devices:

A2985.

A2987.

Drs. Fattouche and Zaghloul invented a way to multiplex (*i.e.*, spread or modulate) data across multiple orthogonal[4] frequencies/codes for transmission over a wireless channel. A818, A3540. Their inventions are what turn a proverbial "slow," single-lane wireless channel into a "high-speed," multi-lane super highway, allowing for the mobile capabilities and applications we have today in smartphones and tablet computers.

---

[4] "Orthogonal" is a mathematical term used to describe frequencies/codes that do not influence each other. A3547*; see also* A732 ("[O]rthogonal is an engineer's way of saying that each of these sounds are so different from one another that they would never be confused.").

Immigrants of modest means, Drs. Fattouche and Zaghloul built Wi-LAN into a major industry player. A789, A810, A817-A818. With their products and through industry organizations they led,[5] Wi-LAN's founders and engineers taught the world how to "cut the cord" to desktop computers and bring high-speed wireless data communications to mobile devices for use in local area networks ("LAN") (*e.g.*, WiFi networks) and cellular networks. A796, A3541-A3544, A819-820. In October 1993, at the NetWorld trade show in Dallas, Wi-LAN introduced its first of many wireless products—the Model 902-20. A796, A3541-A3544, A2931, A2932, A2940-A2957. Wi-LAN demonstrated transmission speeds far beyond those then available, much faster than even the wired data speeds of desktop computers, and led the way to modern mobile devices. A796-A797, A811-A813, A3542.

As a result, Wi-LAN received enormous praise from the telecommunications industry and the press for its wireless multiplexing technologies and products. Many industry experts had previously believed that high-speed wireless data communication was not possible in a mobile environment. A796. This belief was prevalent due to the instability of wireless channels and certain seemingly insurmountable problems. A2161, A3549-3550. Consequently, the industry press

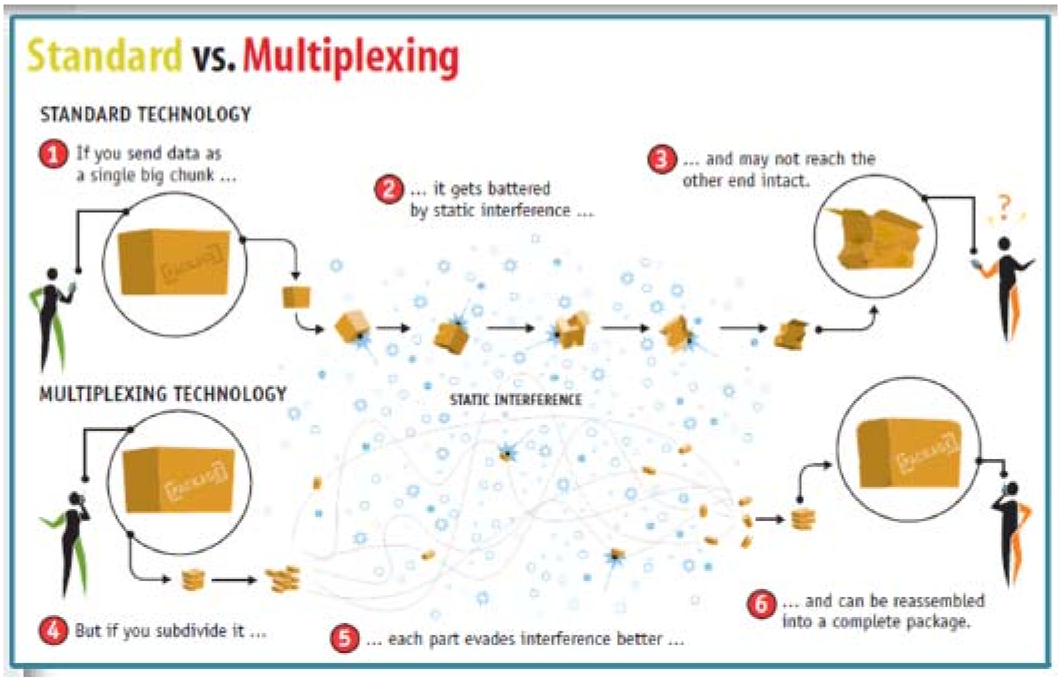
[5] Wi-LAN founded and led the OFDM Forum in 1999 and led the Wi-MAX Forum from 2000-2004. A816, A863, A866, A2963-A2966, A3550-A3551. These organizations included nearly all major telecommunications corporations.

described Wi-LAN's first product as a "bombshell," A2970, and hailed it as remarkable in numerous industry publications: *Communications Week*, *Computer Industry/Computer World*, *Technology in Government*, *InfoWorld*, *Digital News & Review*, *Electronic Engineering Times*, *PCWeek*, and *ComputerWorld*. A2968-2971, A2943-A2948. Industry groups named Wi-LAN's first product the "Best New Technology of the Year." A796-A797, A2967. *Business in Calgary*, a leading Canadian business publication, called Drs. Fattouche and Zaghloul "New Economy Pioneers" and named them "Calgarians of the Year." A819, A2929. News articles described Wi-LAN's technologies as "key to high-speed data products." A2996.

In April 2000, *Time* magazine featured Dr. Zaghloul and Wi-LAN's achievements. A2930. *Maclean's*, the leading Canadian news magazine, included Dr. Zaghloul among a list of Canada's "Great Canadians" in an article titled "Riding the Wave of Invention." A3003, A3023 ("Wi-LAN is one of those next generation companies. Its technology may well become the base for what some call the coming wireless revolution: the ability to e-mail, surf the Net, adjust the lights in your home and order theatre tickets from a cellphone or hand-held computer.").

In October 2000, *Scientific American* described Wi-LAN's patented multiplexing technologies as the future of high-speed wireless data communication

in cellular networks. "To date, wireless multiplexing hasn't been exploited for cellular systems . . . . That may change soon . . . . Wi-LAN holds a number of key patents for a multiplexing technology known as wideband orthogonal frequency division multiplexing, or W-OFDM." A3540. The article included the graphic representation of differences in the standard and multiplexing technologies shown below:



A3540.

Over the past two decades, many wireless standards organizations adopted Wi-LAN's patented multiplexing technologies, starting in 1999 for WiFi standards (IEEE 802.11(a/g/n)), then for 3G cellular standards (CDMA2000, EVDO Rev. A, and HSUPA standards), and more recently for 4G cellular standards. A814-A816, A820.

In addition, Wi-LAN built and sold numerous high-speed wireless products embodying its patented multiplexing technologies: the iWill, BWS, and Libra product families. A819-820, A860-A861. Wi-LAN also initiated and led the effort to persuade the Federal Communications Commission to permit the use of Wi-LAN's wireless multiplexing technologies in the United States airways. A816-A818.

These efforts resulted in Wi-LAN's becoming one of Canada's fastest growing companies, selling wireless products in more than 50 countries. A3001, A2995, A3024. In 2005, however, Wi-LAN was forced to exit the market by larger companies who entered the market using Wi-LAN's wireless technologies without a license. A821, A864-A866. In 2006, Wi-LAN transitioned to a licensing company, but through its wholly-owned subsidiary, Wi-LAN Labs, Inc., formerly Cygnus Broadband, Inc., Wi-LAN continues its tradition of research and development of new wireless technologies and products, in particular for 4G cellular networks. A788-A789. After efforts to negotiate a license failed, Wi-LAN brought this action asserting infringement by Apple's iPhones and iPads that comply with various 3G industry standards with infringement. A412, A413, A417.

With the exception of Apple, all major market participants in the mobile communications industry have licensed Wi-LAN's patented multiplexing technologies.[6]

B. Wi-LAN Asserts Claims 1 and 10 of U.S. Patent No. RE37,802.

This appeal involves Wi-LAN's U.S. Patent No. RE37,802 ("the '802 patent"), A75-A103, filed by Drs. Fattouche and Zaghloul on January 31, 1994, which claims priority as a continuation-in-part to another Wi-LAN patent, U.S. Patent No. 5,282,222 ("the '222 patent"), filed March 31, 1992. A2134-A2168. The '222 patent is Wi-LAN's first patent describing its Wideband Orthogonal Frequency Division Multiplexing ("W-OFDM") technology for use in LANs and cellular networks. A789, A2161. W-OFDM multiplexes data over multiple orthogonal frequencies using Fourier orthogonal spreading codes. A3545-A3551.

Drs. Fattouche and Zaghloul conceived Wi-LAN's second patent, the '802 patent, to adapt their W-OFDM invention for use in Code Division Multiple Access ("CDMA") networks, a type of cellular network. A98, A795, A805-A806, A2575 (March 20, 1993 inventor notebook entry describing the '802 conception for existing CDMA networks and noting "I need to file for [a] patent for a CDMA

[6] Wi-LAN has more than 130 licensees for the '802 and '222 patents, as defined herein. A798, A825. These companies include all of Apple's major competitors over the past decade: Samsung, Motorola, LG, Huawei, RIM/Blackberry, Nokia, Sharp, Philips, and ZTE. A3518-A3521, A825.

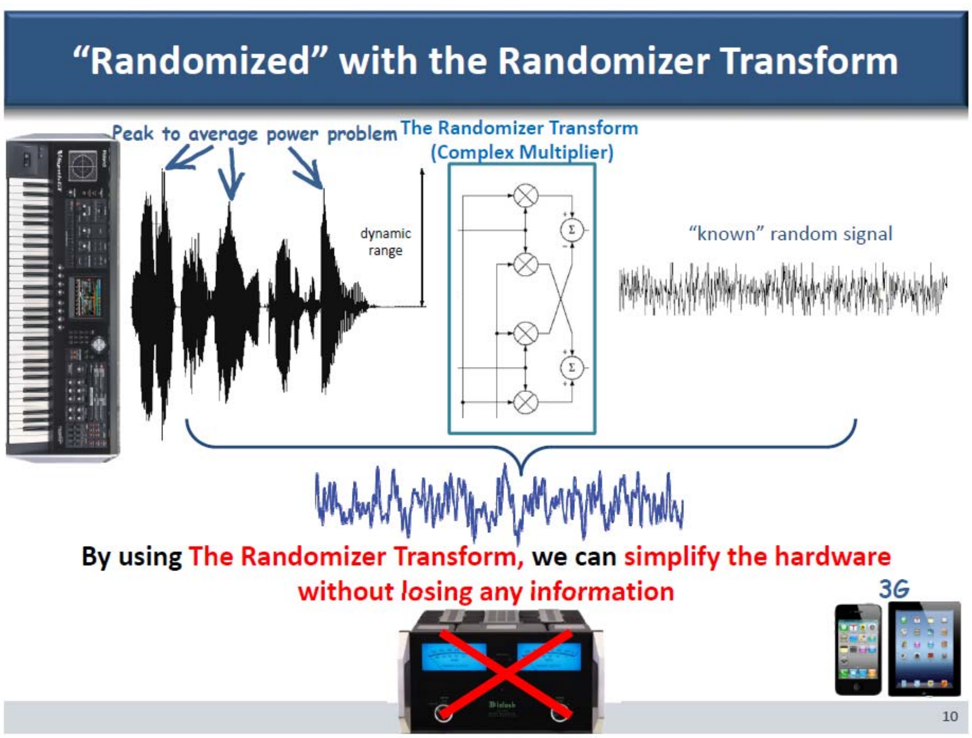
system"). They titled the '802 patent as "Multi Code Direct Sequence Spread Spectrum" (MC-DSSS). A75. MC-DSSS uses multiple orthogonal spreading codes suitable for existing cellular networks, such as Walsh orthogonal spreading codes in one embodiment. A733, A99-A100**.** The '802 patent also discloses the W-OFDM invention of the '222 patent, which uses Fourier orthogonal spreading codes, as another embodiment of MC-DSSS. A100.

The '802 patent claims, including asserted claims 1 and 10, broadly cover MC-DSSS (implemented using Wash codes, Fourier codes, or other orthogonal spreading codes). In addition, the asserted claims include a complex randomizer as an additional structure within the scope of the means-plus-function terms used. The complex randomizer solves the "peak-to-average" power problem that occurs when combining multiplexed data for transmission over a wireless channel. A735-737, A790, A794-A795, A810, A812, A2570, A2801, A3548, A3550. One solution to the "peak-to-average" power problem (the high dynamic range that occurs when modulated/multiplexed data is combined for transmission) is to use linear power amplifiers that operate over a high dynamic range. Such amplifiers, however, are expensive, complex, bulky, and power hungry and, therefore, not suitable for use in mobile devices. A735, A790-A791, A795, A812.

The '802 file history highlighted the benefits of randomization to address the peak-to-average power problem:

> *The key here is the __randomization__ of the [spreading] transformation*. It is known in the art to spread symbols and spread spectrum applications, including by using Walsh codes as shown in *Albrieux et al*. ('952). However, depending upon the data, the effect might be to de-spread the symbols, generating an unwanted pulse. With randomized spreading, it is less likely that a pulse will be generated. Hence, in general, the operation of the invention tends *__to reduce the peak to average intensity ratio__ of the spread signal being transmitted*.

A2342-A2343 (emphasis added). The complex randomizer taught in the '802 patent greatly reduces the dynamic range of the combined modulated data symbols, so that a simple, lightweight, low-cost, linear power amplifier can be used for mobile devices, as shown below. A735-737, A790, A794-A795, A810, A812, A2570, A2801, A3548, A3550.



A735-737.

Incoming from the left, as shown above, modulated data symbols that have been combined into a single complex waveform suffer from the high dynamic range or "peak-to-average" problem. A736-A738, A790-A791, A794-A795. To address this problem, the complex waveform is input into a complex multiplier circuit and multiplied by a known, random signal (represented mathematically as a complex number). *Id*. This complex randomization embeds the waveform within an envelope of a random noise signal to mask the high dynamic range properties of the combined modulated data symbols. *Id*.

Claim 1 of the '802 patent, the only asserted independent claim, covers the transmit side of a MC-DSSS transceiver and has three elements generally summarized in the context of Figure 4 as follows: (1) a converter that separates an incoming data stream to be transmitted into groups of data symbols (which is **not** a means-plus-function term); (2) a "first computing means" for modulating each group of data symbols with orthogonal spreading codes (using the transformer structure 20 shown in Figure 4 of the patent) to produce "modulated data symbols," and a complex randomizer shown in Figure 8 for randomizing the modulated data symbols; and (3) "means to combine" the modulated data symbols using the combiner 14 shown in Figure 4. A75, A81, A100. Asserted dependent claim 10 covers the receiver side of the transceiver. A101.

Figure 4 of the ’802 patent, shown below, illustrates one preferred embodiment of the claimed invention:[7]

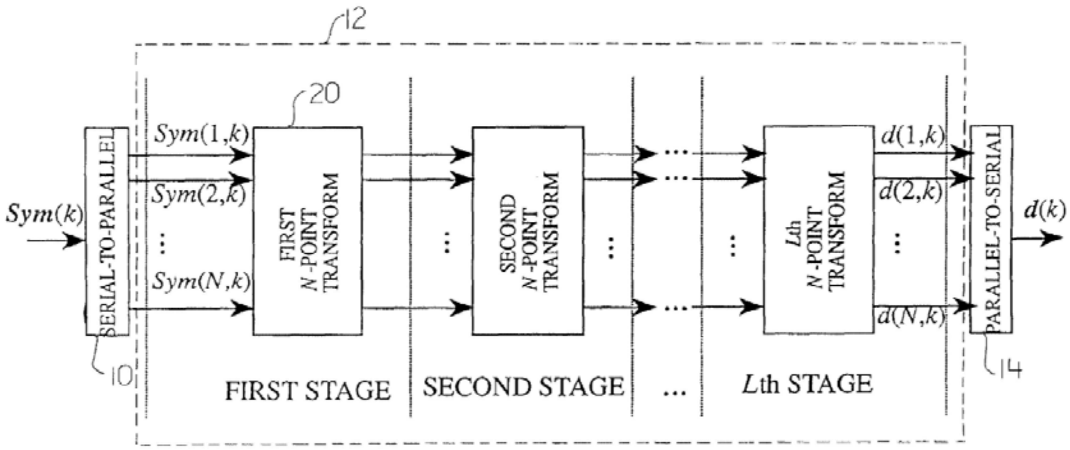


FIGURE 4

A81. In Figure 4, an incoming serial stream of data symbols (Sym(k)) is converted (separated) by a serial-to-parallel converter 10 into groups of data symbols, and each group is then output together as a group across two or more parallel outputs. A81, A99. In distributing the data symbols, more than one symbol for the group can be placed on an output. A791, A749. The data symbols are then modulated (multiplexed) by spreading the data symbols on each parallel output with a different orthogonal spreading code in transformer structure 20. *Id*. Each group of data symbols modulated by the orthogonal codes is combined by combiner 14 in Figure 4 into a single complex waveform for transmission. To avoid the “peak-to-average” power problem discussed above, the ’802 patent teaches that the

[7] Figure 1 in the ’802 patent illustrates an alternative embodiment. A78.

modulated data symbols can also be randomized using the complex multiplier structure shown below in Figure 8. A81, A85, A99, A792.

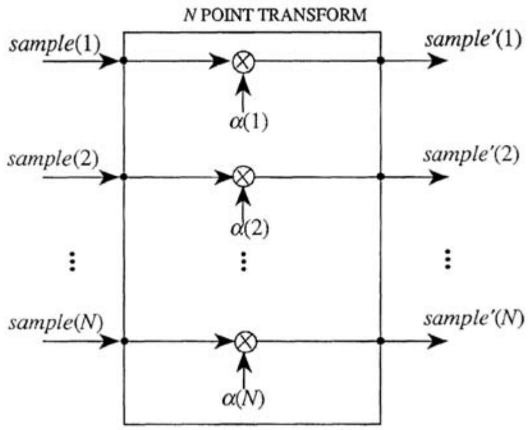


FIGURE 8

A85. The order in which the modulated data symbols are combined by combiner 14 in Figure 4 and randomized by the complex multiplier of Figure 8 is interchangeable. These are linear operations ((A + B) x C = (A x C) + (B x C)) that produce the exact same output (the identical complex waveform for transmission) regardless of their order of operations. A759-A761, A793, A3552, A3564, A1034.

C. Claim Construction Issues Are Resurrected by Apple at Trial.

After a hearing, the court construed two disputed terms/phrases in claims 1 and 10 at issue in this appeal ("converter for converting . . ." and "modulated data symbols") and adopted an agreed-upon construction for a third term ("transceiver") that is also relevant here. A18, A25, A44-A49, A59-A62.

1. First Disputed Phrase: "converter for converting the first stream of data symbols into plural sets of N data symbols each."

The "converter" claim element is highlighted below:

> 1. A transceiver for transmitting a first stream of data symbols, the transceiver comprising:
>
> **a converter for converting the first stream of data symbols into plural sets of N data symbols each;**
>
> first computing means for operating on the plural sets of N data symbols to produce modulated data symbols corresponding to an invertible randomized spreading of the first stream of data symbols; and
>
> means to combine the modulated data symbols for transmission.

A100 (emphasis added).

During *Markman*, Wi-LAN and Apple proposed constructions for both the term "converter" and the functional phrase "converting the first stream of data symbols into plural sets of N data symbols each." The court issued the claim constructions shown below.

CLAIM TERM: "converter."		
Wi-LAN's Proposed Construction	**Apple's Proposed Construction**	**Court's Construction**
"*a device that accepts data symbols in one form or mode and changes the data symbols to another form or mode*"	**"a serial-to-parallel device"**	*"a device that accepts data symbols in one form or mode and <u>changes the data symbols to another form or mode</u>"*

A44-A46 (emphasis added, with *italics* showing similar language, **bolding** showing rejected language and <u>underlining</u> showing language of interest in the chart). The court rejected Apple's proposed construction limiting "converter" to the specific embodiment, that is, "a serial-to-parallel device," *i.e.*, converter 10 as shown in Figure 4. The Court found that "converter" is a structure that "accepts data symbols in one form or mode and changes the data symbols to another form or mode." A46.

The court next rejected Apple's proposed construction limiting the functional phrase "converting the first stream of data symbols into plural sets of N data symbols each" so that each group of data symbols, once converted into a group from the first stream of data symbols, must be output from the converter as *individual* data symbols, *i.e.*, output with only one data symbol on each parallel output path of the converter. A46-A49. At the *Markman* hearing, Apple admitted its proposed construction of "individual" separation of data symbols at the outputs of the converter added an extra limitation into the function of the converter claim

element not present in its plain language: "So what is happening here essentially is the Defendants admittedly are tacking on something to the plain language." A502.

CLAIM TERM: "converting the first stream of data symbols into plural sets of N data symbols each."		
Wi-LAN's Proposed Construction	**Apple's Proposed Construction**	**Court's Construction**
"No construction necessary"	"*taking groups of data symbols from the first data stream, each group having N data symbols,* **and separating each group into N individual data symbols**"	"*separating the first data stream into multiple groups of data symbols such that <u>each group has N data symbols</u>*"

A46-A49. The court's construction omitted Apple's proposed language "and separating each group into N individual data symbols," and expressly rejected Apple's proposal. *Id*. The court explained:

> On balance, Figures 1 and 4 do not warrant limiting the "converting . . ." term here at issue. *See MBO Labs*, 474 F.3d at 1333[8] (noting that "patent coverage is not necessarily limited to inventions that look like the ones in the figures"). The Court therefore **<u>rejects</u> Defendants' proposal that each group must be separated into N <u>individual</u> data symbols**.

A49 (emphasis added). In its *Markman* Order, the court confirmed that "the disputed term [the converting function] should be construed to clarify and explain

[8] *MBO Labs., Inc. v. Becton, Dickinson & Co.*, 474 F.3d 1323, 1333 (Fed. Cir. 2007).

that the [first] stream of data symbols is separated into multiple groups and that each group has N data symbols." *Id*.

At trial, even though the court had rejected Apple's "individual" separation limitation, Apple's expert nonetheless interpreted the court's construction to require the "individual" separation of each group of data symbols by placing only one data symbol on each output path. Specifically, on cross-examination, Apple's expert testified as follows:

> Q. Now, it's true, sir, isn't it that, in fact, the only way your analysis here of what you say the claim requires will work is <u>**if there's ever only one symbol on each rail on the output from the converter**</u>?
>
> A. That's probably correct.
>
> Q. And as a matter of fact, because if you have one symbol on each rail and you have the same number of rails that you have in a group, then N equals N as you showed it, correct?
>
> A. And as the – the Court requires it.
>
> **Q. So what you've done, sir, is <u>you've actually applied the claim in a way that you say the claim is limited to just having</u> <u>one symbol on each outlet path from the converter</u> --**
>
> **A. I think that's --**
>
> **Q. – on each outlet path, right?**
>
> **A. I think that's a logical conclusion. <u>Yes</u>.**

A1055 (emphasis added).

2. Second Disputed Phrase:"modulated data symbols."

During *Markman*, the parties disputed the meaning of the term "modulated data symbols" and its use in the "means to combine the modulated data symbols" claim element of claim 1. The term appears in claims 1 and 4, presented below (with emphasis added). Claim 4 was cited in Wi-LAN's *Markman* brief as intrinsic evidence in support of its proposed construction,[9] A1530, A1560-A1561.

> 1. A transceiver for transmitting a first stream of data symbols, the transceiver comprising:
>
> a converter for converting the first stream of data symbols into plural sets of N data symbols each;
>
> *first computing means* for operating on the plural sets of N data symbols *to produce* ***<u>modulated data symbols</u>*** corresponding to an invertible ***<u>randomized</u>*** spreading of the first stream of data symbols; and
>
> *means to combine* **the modulated data symbols** *for* transmission.
>
> 4. The transceiver of claim 1 in which *the first computing means comprises:*
>
> *a transformer* for operating on each set of N data symbols <u>*to generate* ***modulated data symbols***</u>

[9] In its JMOL order, the court stated: "Wi-LAN also contends that dependent claim 4 confirms that Apple's interpretation of ordering is incorrect. The Court is not persuaded by an argument on claim construction raised for the first time in post-trial briefing." A14. The court mistakenly overlooked the fact that Wi-LAN had included the assertion that claim 4 supported its construction in its *Markman* briefing. A1560-1561.

> <u>*as output*</u>, <u>*the modulated data symbols corresponding to **spreading***</u> of each data symbol over a separate code selected from a set of more than one and up to M codes, where M is the number of chips per code; *and*
>
> *means to combine* ***the modulated data symbols*** for transmission.

A100-A101 (emphasis added). The parties' proposed constructions and the court's claim construction are shown below:

CLAIM TERM: "modulated data symbols."		
Wi-LAN's Proposed Construction	**Apple's Proposed Construction**	**Court's Construction**
"*data symbols that have been spread by a spreading code*"	"*spread* <u>**and**</u> pseudo-<u>r**andomized**</u> *symbols*"	"*data symbols that have been spread by a spreading code*"

A59, A62.

The court adopted Wi-LAN's proposed construction for the "modulated data symbols," and rejected Apple's proposed requirement that the "modulated data symbols" be construed as symbols that are both spread with a spreading code *and* randomized by the complex randomizer. The court explained:

> On balance, **neither the specification nor the prosecution history contain any definitive statement or disclaimer mandating that 'modulated data symbols' must be pseudo-randomized**. *Omega Eng. v. Raytek Corp.*, 334 F.3d 1314, 1324 (Fed. Cir. 2003) ("As a basic principle of claim interpretation, prosecution disclaimer promotes the public notice function of the intrinsic evidence and protects the public's reliance on

> *definitive* statements made during prosecution.") (emphasis added). Instead, randomization is a desirable feature that is addressed by other claim language, such as the term "invertible randomized spreading," which appears in Claim 1 and is discussed in Section V.D., above. **Randomization therefore should not be imported into the term "modulated data symbols."** *Electro Med.*, 34 F.3d at 1054.

A61-A62 (emphasis added).

The '802 patent states that "modulated data symbols" are produced by spreading a data symbol with a spreading code, not that they are produced by both spreading with a spreading code *and* randomizing, as Apple unsuccessfully argued during the *Markman* phase. A99 ("to generate N modulated data symbols . . . spread each I data symbol over a separate code symbol"). Accordingly, the "means to combine the modulated data symbols" of claims 1 and 4 need only combine data symbols that are spread with a spreading code. There is no requirement in claims 1 and 4 to combine "modulated data symbols" only after the modulated data symbols are randomized. Nothing in the '802 patent specification, claims, or claim constructions requires a specific order of operations (*i.e.*, to spread (to produce modulated data symbols), randomize, then combine). Claim 4 shows that "the modulated data symbols" are defined in the intrinsic record as data symbols spread with a spreading code and also shows that the "means to combine" can be placed between the two structures of the first computing means (that perform the function of spreading and randomizing) and need not wait to combine

the modulated data symbols until after they are randomized. One of ordinary skill in the art understood that the order of combining and randomizing the modulated data symbols is interchangeable and produces the same output. *See, supra*, p. 14.

The ’802 patent discloses separate structures for spreading and randomizing data symbols, further demonstrating that modulated data symbols (spread data symbols) are different from spread *and* randomized data symbols. A81, A85. Transformer structure 20 of the first computing means 12 in the Figure 4 embodiment spreads each data symbol with an orthogonal spreading code to produce modulated data symbols. A99. The complex multiplier structure in Figure 8 is the structure that randomizes the modulated data symbols. As explained earlier, this complex multiplier structure (and the randomization it imposes on the modulated data symbols) addresses the “peak-to-average” power problem to enable use of Wi-LAN’s multiplexing technologies for mobile devices. *See, supra*, pp. 10-12.

Consequently, there are two structures in the ’802 patent used to perform the functions of the “first computing means” to produce modulated data symbols “corresponding to an invertible *randomized spreading*.” The first structure is the transformer structure 20 in Figure 4 that spreads the data symbols to produce modulated data symbols, and the second structure is the complex multiplier structure in Figure 8 that randomizes the modulated data symbols.

At trial, though Apple did not argue this issue at *Markman*, Apple's counsel and its expert argued to the jury that the use of the antecedent article "the" before the term "modulated data symbols" in the "means to combine" limitation necessarily requires that the "modulated data symbols" be randomized *before* they are combined in the "means to combine," because the functions of the first computing means are intended to produce modulated data symbols "corresponding to an invertible randomized spreading." A1026, A1031-A1032.

D. Apple Argued To The Jury That The '802 Patent Was Limited to LANs and Excluded Cellular.

During the *Markman* phase, the parties agreed to the construction of "transceiver," found in the preamble of claims 1 and 10, as "a device that transmits and receives data." A18, A25. Neither the claim language nor the agreed constructions limited the scope of the asserted claims only to LAN (WiFi) transceivers or excluded cellular transceivers. Apple never proposed that the court limit the "transceiver," or any other term in asserted claims 1 and 10, to WiFi- or LAN-only transceivers.

At trial, Apple's counsel and its expert repeatedly misrepresented to the jury that the '802 patent is a WiFi or LAN-only patent, not a cellular patent. Starting with its opening statement, continuing through fact and expert testimony, and ending in closing, Apple presented this "LAN/WiFi vs. Cellular" argument to the jury.

In its opening, Apple urged the jury to limit the scope of the ’802 patent to WiFi or LAN transceivers and to exclude cellular transceivers, even though that issue is purely one of claim construction and even though Apple never sought to have the court construe the claims that way. Apple’s opening statement included the following:

> Well, it’s important, when you think about Wi-LAN, to understand the distinction between LAN technology, and we talked a little bit earlier about what LAN technology was and cell technology. **Wi-LAN was involved in WiFi technology, which we refer to as LAN technology. And how do you know that? Well, you know that, first of all, by looking at Wi-LAN’s name. They’re not Wi-Cell; they’re Wi-LAN.** So their name indicates their -- their desire to work in the wireless LAN space. They weren’t working in cell; they were working in wireless LAN. They were working in Wi-LAN. . . .
>
> So let’s look at the ’802 patent. **Again, I think what Wi-LAN is going to try to tell you is that this patent up here is a cell patent**; that it’s not a -- it’s not -- it’s not a WiFi patent or it’s not a LAN patent. It’s a cell patent. And how are you going to figure that out, right? **Because Mr. Cote [Wi-LAN’s Counsel] is going to tell you it’s a cell patent, and I’m going to tell you it’s a WiFi patent. You don’t know who to believe. You don’t know either one of us. But you have the evidence. . . .**

A718 (emphasis added). Apple’s theme that the ’802 patent covered only WiFi and LAN devices, not Apple’s cellular devices, was echoed repeatedly in Apple’s cross-examination of the inventors and fact witnesses and its expert’s testimony. A767, A800, A831-A832, A854-A855, A1071. For example, during Apple’s cross

examination of the inventors, Apple repeatedly asked whether or not the ’802 patent contained the word “cellular” and omitted the fact that the ’802 patent also does not contain the words “WiFi” or “LAN.” A855.

Apple also urged the jury in its closing to limit the claim scope of the ’802 patent to WiFi or LAN transceivers:

> Again, the ’802 patent, as we’ve said over and over again, **it’s not a cell phone patent. It’s a LAN patent. It’s a WiFi patent**. . . . **And they named their company Wi-LAN because that’s what they were going into, the LAN space.**

A1170 (emphasis added).

E. Wi-LAN Presented Unrebutted Infringement Evidence.

At trial, Wi-LAN’s expert provided a detailed, element-by-element analysis to demonstrate that the accused Apple devices, namely Apple’s 3G iPhones and iPads,[10] designed to operate in accordance with the three cellular industry standards, CDMA2000, EV-DO Rev. A, and HSUPA, literally met each element of asserted claims 1 and 10, as those claims had been construed by the court. A746-A752, A835-A840.

A743-A745, A748, A1133-A1134. Wi-LAN’s expert based his infringement opinion on a variety of sources, including

[10] The parties agreed to use a 3G Apple iPad, as the representative accused Apple device, for all of Apple’s accused products. A1430-1439.

the court's claim construction, the 3G industry standards, Apple's source code and documents, and source code and documents. A743-A745, A7304, A7305, A4142-A5224, A5225-A6744, A6777-A6860, A9384-A10099, A3574-A4141, A6861-A7303, A6745-A6776, A7306-A9383.

During the subsequent cross-examination of Wi-LAN's expert, Apple never attempted to show that Wi-LAN's analysis incorrectly described the structure and operation of the accused device.[11] Rather, in its case in chief, Apple's expert presented an interpretation of the claims that added claim limitations that were *not* part of the court's claim constructions. A1026-A1027. By doing so, Apple invited the jury to re-construe the terms ("transceiver," "converter for converting . . ." and "means to combine the modulated data symbols" claim elements). A1025-A1035, A1071.

Wi-LAN also presented evidence at trial establishing infringement of asserted claims 1 and 10 under the doctrine of equivalents ("DOE"). A759-A761. Wi-LAN's expert showed that the order of the recited functions in the claim

---

[11]The only factual dispute as to the operation of the representative accused product was with regard to the "converter" element for the CDMA 2000 3G cellular functionality in the accused Apple products. However, the accused device practices the CDMA 2000 3G functionality and also supports the EV-DO 3G functionality, about which there was no factual dispute as to its operation, including how the "converter" element operates. A1080. Thus, any factual dispute regarding the CDMA 2000 functionality and the accused device was moot, because those same devices practiced the infringing EV-DO 3G functionality, about which the parties had no factual dispute.

(combining and randomizing the modulated data symbols) was insubstantially different, interchangeable, and equivalent regardless of whether the modulated data symbols (when produced by spreading with a spreading code) were (1) randomized and then combined, or (2) combined and then randomized (as in Apple's accused products). A760-A762. Specifically, Wi-LAN's expert testified to the mathematical linearity of the randomizing and combining operations, which renders the specific sequence of operations insubstantially different and equivalent. A759-A761. Randomizing (multiplying) and combining (adding) are linear operations whose result does not depend on the order in which they occur. *Id*. In short, (A + B) x C = (A x C) + (B x C). *Id*.

Supporting his opinion, Wi-LAN's expert cited documents

A761, A3025, A3113. Wi-LAN's expert also cited a Qualcomm patent that was prior art to the '802 patent, which states: "It is well known in the art that *the order of linear operations may be interchanged*." A3552, A3564, A761.

Apple's expert admitted that "from a mathematical view if all other things were equal, the order in which the operations [combining and randomizing] are performed wouldn't matter." A1034. The only substantive testimony provided by Apple's expert as to why "order matters" is that the Qualcomm microchip in the accused device requires fewer transistors because the combining of the modulated data symbols happens before randomizing in the accused products. A1032-A1034. But Apple's expert also admitted that out of hundreds of millions of transistors in the Qualcomm microchip for the accused device, approximately twenty fewer transistors are required (a difference of less than *0.00002%*). A1053-A1054.

F. The Court Denied Wi-LAN's Motion For JMOL on Infringement.

After the conclusion of all evidence at trial, Wi-LAN moved for JMOL under Rule 50 requesting the court find infringement, as a matter of law, of claims 1 and 10 of the '802 patent, either literally or under DOE, which motion was denied. A1137-A1138, A1141. After the jury's verdict finding no infringement, Wi-LAN renewed its motion for JMOL. A361-A365, A1190-A1227. Wi-LAN argued that the claim interpretations that Apple advanced at trial were improper limitations on the scope of the claims, had been rejected by the court during *Markman* in the claim construction order, and had not been included in instructions to the jury on the meaning of the claim. Therefore, the jury verdict was not

supported by substantial evidence under the claim constructions given to the jury. A1208-A1221.

The court denied Wi-LAN's renewed JMOL motion. A2-A17. Regarding the "converter for converting . . ." limitation, the court stated:

> The argument that each group must be separated into N individual data symbols was previously rejected by the Court. However, the Court did not reject the notion that the data must be **evenly separated into multiple groups** of N data symbols each. Therefore, the number of *groups* of N data symbols does not have to equal N, although **each group must contain the *same N number* of data symbols.**

A12 (emphasis in italics in original; bolding emphasis added). The court confirmed its construction rejecting an "individual" separation limitation for the "converter for converting . . ." element, and the court again held that the incoming data stream must be "evenly separated in multiple groups . . . [and] "each group must contain the same number of data symbols." *Id*. Apple did not dispute that its accused devices met this limitation. A12. The court, however, found that Apple's expert's opinion adding a limitation supported the non-infringement verdict. *Id*.

Regarding "the modulated data symbols" term, the court adopted Apple's post-judgment antecedent argument that adds a required sequence to the *Markman* definition such that the modulated data symbols are first randomized and then combined:

> As a qualified technical expert, [Apple's expert] Dr. Acampora was entitled to give his opinion that from his study of the language in claim 1 and the Court's constructions of certain terms, **those particular modulated data symbols must be spread and randomized before being combined.**

A14 (emphasis added). The court had rejected this construction in its *Markman* Order, but adopted it *after* the jury had been instructed on a non-sequenced definition and had rendered its verdict.

The court further stated that it was proper to argue claim interpretations to the jury:

> **The jury heard both sides' interpretation of the claim language, considered the experts' competing testimony, and rendered a verdict of no infringement. As is apparent from the verdict, the jury had reason to believe [Apple's expert] Dr. Acampora's testimony and disbelieve the opinions of [Wi-LAN's expert] Dr. Orsak.** This Court may not supplant the jury's assignment of credibility or weight attributed as between the experts, as those are sole functions of the jury. Indeed, Wi-LAN has made no claim that the evidence supporting non-infringement presented at trial was insufficient, only that Apple's interpretation of the terms conflicts with the Court's construction. Having determined that there is no inconsistency, the Court concludes that Wi-LAN has failed to meet its burden of persuasion on this issue and there is no cause to overturn the jury's verdict of non-infringement.

A14-A15 (emphasis added).

Wi-LAN alternatively moved for a new trial on the grounds submitted on JMOL for infringement and additionally argued that Apple's LAN (WiFi)-versus-

Cellular argument confused the jury. The court disagreed with Wi-LAN's jury confusion arguments. A15-A16.

Wi-LAN timely appealed the court's JMOL decision and judgment. A252. Wi-LAN requests that judgment for Apple on non-infringement be reversed and a judgment of infringement entered, and the case remanded for a determination of damages. Alternatively, Wi-LAN submits that the non-infringement judgment should be reversed and the case remanded for a new trial on infringement and damages.

V. SUMMARY OF ARGUMENT

The court denied Wi-LAN's JMOL on infringement and alternative motion for new trial. Wi-LAN seeks reversal. The JMOL order failed to enforce the *Markman* claim constructions that the jury was instructed to apply. There was no relevant dispute at trial concerning the structure and operation of Apple's 3G cellular devices. Consequently, whether claims 1 and 10 are infringed under the constructions the jury was instructed to apply is a question of law to be resolved by this Court *de novo.*

Apple's expert improperly resurrected a proposed interpretation rejected at *Markman* for the term "converter for converting . . . ." Apple's expert testified that the converter must not only evenly separate a first steam of data symbols into groups of data symbols, where each group has the same number of N data symbols

(as included in the jury instructions), but must also *evenly separate* each group of data symbols into "N *individual* data symbols" by placing only one data symbol from the group on each of the converter's output paths.

In its JMOL opinion, the court acknowledged its *Markman* rejection of Apple's proposed construction separating each group of N data symbols into N *individual* data symbols on the converter's output paths: "the argument that each group must be separated into N individual data symbols was previously rejected by the Court." This rejected construction was the basis for Apple's non-infringement defense. The court held: "However, the Court did not reject the notion that the data must be evenly separated into multiple groups of N data symbols each. Therefore . . . each group must contain the same N number of data symbols." This requirement that the data must be "evenly separated into multiple groups of N data symbols each" is the construction given to the jury. Consequently, the court erred in finding that Apple's expert's opinion supported a verdict of non-infringement because the expert's testimony agreed that the accused device "evenly separated data into groups of N data symbols each.

The court also denied Wi-LAN's JMOL to enforce the court's claim construction of the term "modulated data symbols" (defined as "data symbols that have been *spread* by a spreading code") appearing in the "means to combine" element of claims 1 and 10. The court's *Markman* order rejected Apple's proposed

construction of the term as data symbols that have been *both spread and randomized*. At trial, however, Apple's expert presented this rejected claim construction issue to the jury, testifying that the "means to combine" must combine data symbols that have been *both spread and randomized*. Apple's accused products would not literally infringe under this interpretation because they first combine spread data symbols and then randomize. There is, however, no temporal language in apparatus claims 1 and 10 that would require the sequence of operations that Apple's expert added to the construction. Moreover, Apple's expert acknowledged the "linear" characteristic of the randomizing and combining operations., which means these functions produce the same output regardless of the order in which they are applied Evidence at trial conclusively established that persons of skill in the art recognized this linearity and that the randomizing and combining operations could be performed in any order.

The court's JMOL decision failed to enforce its claim construction and held that the jury was entitled to adopt Apple's expert's interpretation of the claim language. The court reasoned that the "jury heard both sides' *interpretations* of the claim language, considered the experts' competing testimony, and rendered a verdict of no infringement," even though the jury had been instructed only that "modulated data symbols" are symbols that have been "spread." The court erred because Apple's "interpretation" of the claim terms improperly imposed an order

of operations limitation that does not appear in the claim or in the claim construction given to the jury.

Wi-LAN also sought a new trial on the same grounds set forth in its JMOL motion, which was denied based on the court's reasoning discussed above. Wi-LAN further sought a new trial based on Apple's pervasive trial argument that the '802 patent, including asserted claims 1 and 10, covered only LAN(WiFi) devices and excluded cellular devices. The court's instructions required the jury to compare the accused products to the asserted claims to determine infringement. Claims 1 and 10 do not, as stipulated by Apple and as admitted by Apple's expert, contain language excluding a cellular "transceiver" or limiting the scope of the claim term "transceiver" to WiFi or LAN. Wi-LAN seeks a new trial because the jury could not have found non-infringement without ignoring jury instructions on the meaning of this claim term and the other claim terms that are at issue in this appeal and thus ignoring the proper analysis for determining infringement. Apple's misdirection created juror confusion and brought about a verdict that ignored and failed to analyze Apple's accused products under the jury instructions. Thus, Wi-LAN alternatively seeks reversal of the district court's denial of a new trial and requests a new trial on infringement and damages.

VI. ARGUMENT

A. Standards of Review

1. Standard of Review of a JMOL Decision.

A decision denying a motion for JMOL is reviewed *de novo* by applying the same standard as that applied by the court. *Seachange Int'l Inc. v. C-COR Inc.*, 413 F.3d 1361, 1367-68 (Fed. Cir. 2005). Under governing Fifth Circuit law, JMOL must be granted against a defendant when it has been fully heard on an issue and there is no legal or evidentiary basis for a reasonable jury to have found for the defendant with respect to that issue. *See Ford v. Cimarron Ins. Co.*, 230 F.3d 828, 830 (5th Cir. 2000).

Infringement analysis includes two steps: (1) determining the meaning and scope of the asserted claims and (2) comparing the properly construed claims to the device accused of infringing. *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 976 (Fed. Cir. 1995) (en banc), *aff'd*, 517 U.S. 370 (1996). The first step is a question of law, reviewed *de novo, Cybor Corp. v. FAS Technologies, Inc.*, 138 F.3d 1448, 1454-55 (Fed. Cir. 1998) (en banc), and the second step is a question of fact, reviewed under a substantial evidence standard, *Schindler Elevator Corp. v. Otis Elevator Co.*, 593 F.3d 1275, 1281 (Fed. Cir. 2010).

Where (1) the jury verdict is plainly at odds with the claim constructions given by the court, *i.e.*, plainly at odds with the correct legal standards; and (2) the verdict is not supported by substantial evidence in the record when the correct legal

standards are applied, the verdict should be overturned as a matter of law. *See Markman*, 52 F.3d at 975. When the only evidence that a party offers at trial is based on an erroneous application of the claim constructions, that evidence should be disregarded, and JMOL may be entered against the party. *See Moba, B.V. v. Diamond Automation, Inc.*, 325 F.3d 1306, 1313-14 (Fed. Cir. 2003).

2. Standard of Review for New Trial.

A new trial is proper if the court "suspects that the jury verdict reflects confusion," *Nissho-Iwai Co. v. Occidental Crude Sales, Inc.*, 729 F.2d 1530, 1538 (5th Cir. 1984), or the court "'finds the verdict is against the weight of the evidence, . . . the trial was unfair, or prejudicial error was committed in its course.'" *Smith v. Transworld Drilling Co.*, 773 F.2d 610, 613 (5th Cir. 1985); FED. R. CIV. P. 59(a)(1). The standard for a new trial is lower than that for JMOL, because a "verdict can be against the 'great weight of the evidence,' and thus justify a new trial, even if there is substantial evidence to support it." *Whitehead v. Food Max of Mississippi, Inc.*, 163 F.3d 265, 270 (5th Cir. 1998). In deciding to grant a new trial, the court "need not take the view of the evidence most favorable to the verdict winner, . . . but may weigh the evidence." *Id.* The court "may and should exercise a sound discretion" in deciding whether to grant a new trial on any issue. *Id.*

B. This Court Should Reverse the Denial of the JMOL and Find as a Matter of Law that Apple Infringes Claims 1 and 10 of the '802 Patent.

1. Determinations of Claim Scope Are Not Jury Issues.

"The construction of a patent, including terms of art within its claim, is *exclusively within the province of the court*." *Markman v. Westview Instruments, Inc*., 517 U.S. 370 (1996) (emphasis added). This Court has repeatedly explained that it is error for the court to allow the jury to consider disputes over claim scope. *See, e.g*., *Sundance, Inc. v. DeMonte Fabricating Ltd*, 550 F.3d 1356, 1364 n.6 (Fed. Cir. 2008) ("[O]ur court has held that allowing a witness to testify *before the jury* on claim construction would be improper."); *Cytologix Corp. v. Ventana Med. Sys., Inc*., 424 F.3d 1168, 1172 (Fed. Cir. 2005) ("[T]he risk of confusing the jury is high when experts opine on claim construction before the jury."); *O2 Micro Int'l Ltd. v. Beyond Innovation Tech. Co.*, 521 F.3d 1351, 1360 (Fed. Cir. 2008) ("[W]hen the parties raise an actual dispute regarding the proper scope of [the patent] claims, the court, not the jury, must resolve that dispute.").

The Federal Circuit has ruled that a party does not waive a claim construction argument for JMOL purposes that seeks *enforcement* of the court's claim constructions that the court instructed the jury to use in making its

infringement determination.[12] *See Moba*, 325 F.3d at 1313-14. In *Moba*, this Court stated:

> The district court's instructions to the jury did not require sequential performance. In essence, the district court allowed the jury to add an additional limitation to the district court's construction of 'guiding steps.'
>
> In this, the district court erred. Claim construction is a question of law and is not the province of the jury. *Markman*, 52 F.3d at 979. . . . The record before us discloses no alternative basis upon which a reasonable jury could find that the Moba Omnia does not infringe, other than that the Moba Omnia does not satisfy the guiding steps limitation. **Thus, by allowing the jury to import an additional limitation into the claims, the district court fundamentally altered the verdict.**

---

[12] Nonetheless, Wi-LAN objected to Apple's improper claim construction arguments before and during trial.

A1451-A1452. At the pre-trial hearing, Wi-LAN specifically raised the issue and articulated the underlying concern:

> And what we want to make sure is going to happen here, Your Honor, is that **we're not somehow going to get an expert up on the stand who's going to try to back door in some limitation beyond Your Honor's claim construction**. . . .

A594. Apple appeared to agree with Wi-LAN, recognizing that "you can't go beyond what the Court's claim construction is, don't intend to, really no basis to make that statement." A595. In view of Apple's representation, the court denied Wi-LAN's motion as moot. *Id.* Wi-LAN objected when Apple first resurrected its claim construction arguments in its opening demonstratives at trial, but the court denied Wi-LAN's objection. A698-A699, A701.

Id. (emphasis added).

2. Apple Argued Claim Construction Issues to the Jury.

Apple presented no defenses to infringement of claims 1 and 10 of the ’802 patent under the court’s claim constructions. Under the correctly applied jury instructions, the uncontroverted evidence establishes that Apple’s accused device infringes the ’802 patent.[13] Because there is no relevant dispute concerning the structure or operation of the representative accused devices, the issue of whether the claim language reads on the accused device is purely one of claim construction and is properly resolved as a matter of law by this Court. *See Moba*, 325 F.3d at 1313. For these reasons, the Court should reverse the denial of JMOL of infringement of claims l and 10 of the ’802 patent.

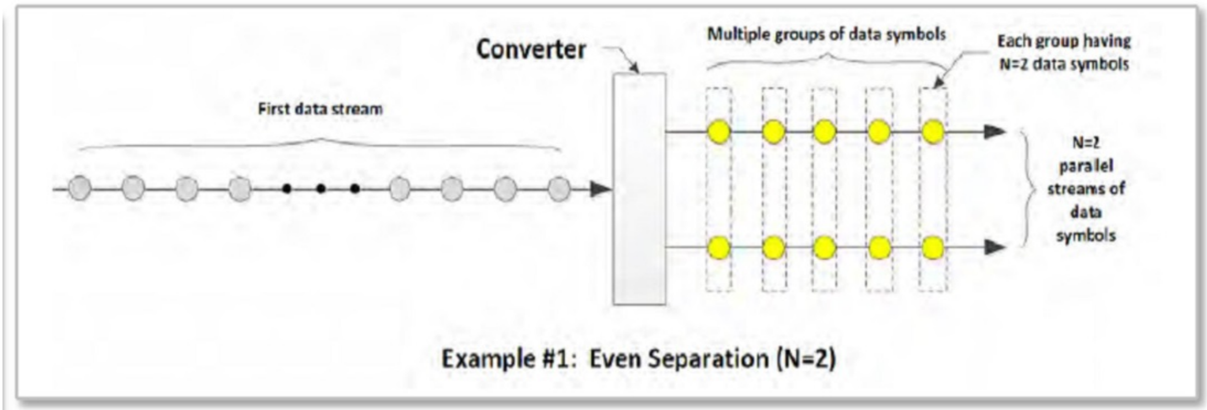
3. No Evidence Supports the Verdict of Non-Infringement under the Court’s Construction of a “Converter for Converting the First Stream of Data Symbols into Plural Sets of N Data Symbols Each.”

Apple argued at *Markman* that the converter in claim 1 must not only separate the incoming data stream (the “first stream of data symbols”) into groups

[13] The court in its JMOL decision stated that Wi-LAN had “made no claim that the evidence supporting non-infringement presented at trial was insufficient, only that Apple’s interpretation of the terms conflicts with the Court’s construction.” A14-A15. To the extent that the court’s statement about sufficiency of the evidence relates to the fact that the structure and operation of the accused device were not disputed (either as described by Apple’s or Wi-LAN’s expert), Wi-LAN concurs. But that is precisely why JMOL should have been granted—because no disputes exist as to the accused devices and how they operate, only as to whether the jury applied the claim constructions they were instructed to apply, which they did not.

of N data symbols each ("into plural sets of N data symbols each"), but must further separate each group at the outputs of the converter into N *individual* data symbols, *i.e.*, placing each data symbol of the group on a separate parallel output of a serial-to-parallel converter. A502-A503. The court, however, rejected Apple's proposed "individual" separation construction, and construed the "converting . . ." claim language to mean "separating the first data stream into multiple groups of data symbols such that each group has N data symbols." In its *Markman* order, the court rejected Apple's notion that the "converter for converting . . ." claim element must put each individual data symbol in a group on separate, parallel output paths and that the converter must necessarily be a serial-to-parallel converter. A44-A49. Despite the court's express rejection of Apple's proposed constructions, Apple's expert told the jury that the claim "required" Apple's rejected construction. Apple's expert presented illustrations to the jury of Apple's "individual" separation requirement (what Apple's expert renamed "Even Separation of the data symbols in each group so that only one data symbol from the group is placed on each parallel output of the converter").

Apple's expert presented Example #1 below to illustrate his interpretation of the "converter for converting . . ." claim element that he said complied with the court's claim construction:

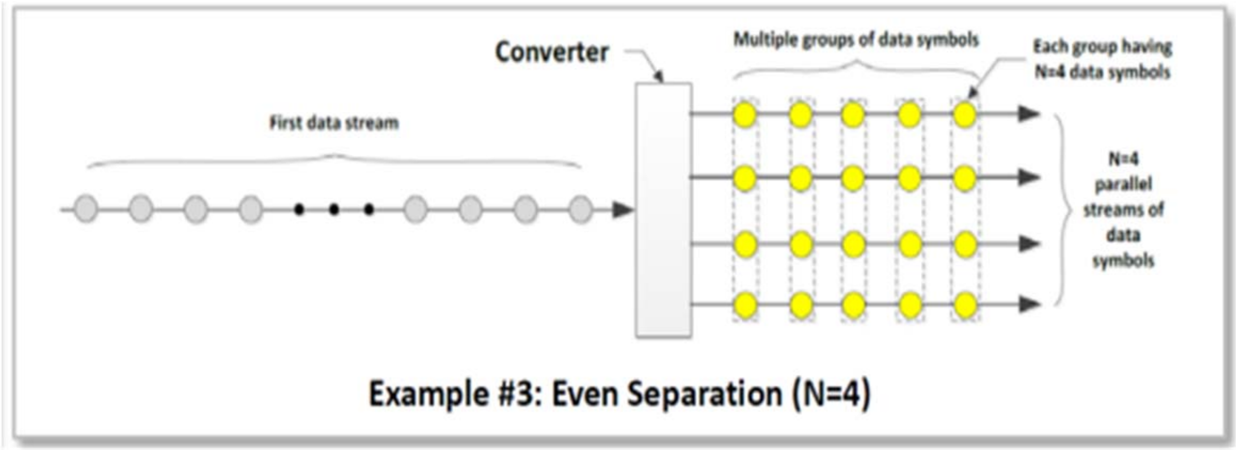


A1026-1027. Apple's expert told the jury:

> Example 1 shows a so-called **even separation** of symbols. So symbols came marching in from the left. That was the first stream. And those symbols were converted into parallel format. And you see the groups. In this case, there are five groups that are marching off to the right.
>
> **And each group contains two symbols. So we see that the number of symbols in each group is two, and the number of parallel streams is also two. That example complies with the Court's claim construction.**

A1027 (emphasis added).

Apple's expert presented another example, Example #3 below, to illustrate his interpretation of the same element that he said complied with the court's claim construction:

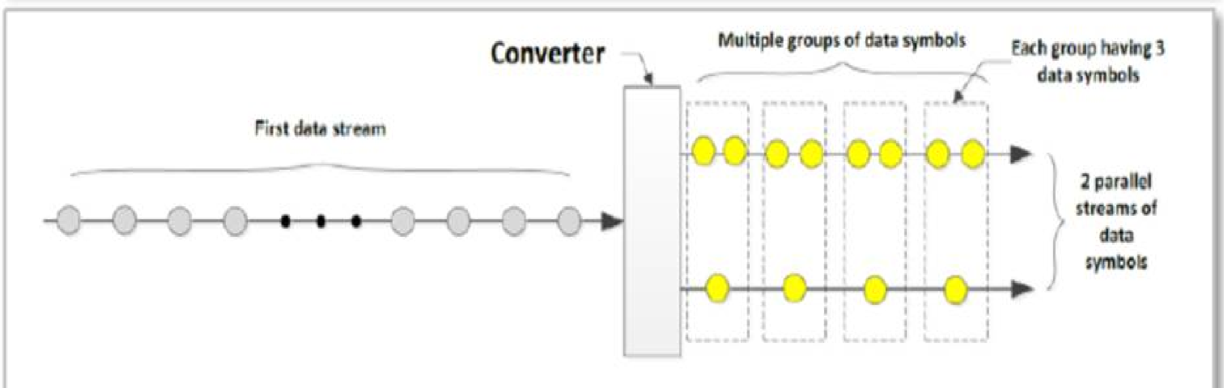


A1027. In describing Example #3's "even separation," Apple's expert stated:

> Once again, symbols coming in from the left. In this case, the serial-to-parallel converter produces four parallel streams. We see five groups leaving. **Each group contains four symbols. The number of parallel streams is, again, four. This example would conform with the Court's claim construction.**

A1027 (emphasis added). Both examples separated (converted) the incoming first stream of data symbols into groups of "N" data symbols and then separated the data symbols in the group at the output evenly such that each individual symbol in a group was placed on a separate, parallel output path.

Apple's expert further presented Example #2 to the jury, which he opined did *not* comply with the court's claim construction. A1027. Example #2 represents the structure and function of the accused device. A1027. As shown below, the converter of the accused device separates the incoming data stream into groups of data symbols, such that each group has the same number of N data symbols (N=3 data symbols per group).



Example #2: Uneven Separation

Apple's expert, however, characterized Example #2 as illustrating "Uneven Separation" because each group of N data symbols converted to a parallel format is not *further* equally separated when output from the converter such that each symbol from a group is placed individually on a separate, parallel output path of a serial-to-parallel converter. In other words, the number of symbols (3) in each group does not equal the number of output paths (2):

> In this case, symbols come in from the left once again. They're converted into a different format, a parallel format. And we see four groups marching off to the right. **Each group contains in this case three -- three elements, but there are … only two streams [outputs]. So three does not equal to two**.
>
> **The Court's construction has told us the number of parallel streams must equal the number in each group. So the second example would not meet the Court's claim limitation.**

A1027 (emphasis added).

It is significant that all three of Apple's examples show multiple groups of data symbols, with each group having "N" number of data symbols, which is the

only requirement in the court's construction. Each example converts the first data stream to parallel output paths. The only difference in the examples is that Examples #1 and #3 show the converter individually separating the data symbols in the group so that only one data symbol from the group is placed on each output path; but in Example #2 the converter does not individually separate the data symbols in the group so that only one data symbol from the group is placed on each parallel output path. Instead, two data symbols from the three-symbol group are placed on one of the parallel output paths and the remaining data symbol from the group is placed on the other parallel output path. One data symbol per output path is not required by the court's construction.

In making this argument, Apple's expert improperly imported the re-packaged "individual separation" limitation that the court had expressly rejected at *Markman* and in its place used the terms "even separation" for the words "individual separation." By doing so, Apple improperly re-argued its rejected claim construction for the "converter for converting . . ." claim term—this time to the jury:

> Q. And, as a matter of fact, one of the things that you were explaining to us is this -- I think you called it the even separation requirement, right?
>
> A. Something like that. Yes.
>
> Q. Actually –
>
> A. Even split. Even separation, even split.

> Q. In fact, as a matter of fact, in your expert report, that's exactly what you called it, right, the even separation requirement?
>
> A. I believe that I did.
>
> Q. Okay. Very good.
>
> **And what you were talking about there, sir, is that you don't think that the claim can cover putting two symbols on the top rail and one symbol on the bottom, right?**
>
> A. **That's correct**.
>
> Q. That's because **you think that the number of symbols in a group has to equal the number of rails**. So N has to equal N; 2 here in your example, right?
>
> A. **Well, yes. That's what the Court's claim construction has told us.**

A1054 (emphasis added).

Leaving no ambiguity, Apple's expert went on to admit that his application of the court's claim construction for the "converter" required placing each single, individual data symbol from a group on a separate output path:"

> Q. Now, it's true, sir, isn't it that, in fact, the only way your analysis here of what you say the claim requires will work is if there's ever only **one symbol on each rail on the output from the converter**?
>
> A. That's probably **correct**.
>
> Q. And as a matter of fact, because if you have one symbol on each rail and you have the same number of rails that you have in a group, then N equals N as you showed it, correct?

A. And as the – the Court requires it.

Q. So what you've done, sir, is you've actually applied the claim in a way that you say the claim is limited to just having one symbol on each outlet path from the converter --

A. I think that's --

Q. – on each outlet path, right?

A. I think that's a logical conclusion. Yes.

A1055 (emphasis added).

a. Wi-LAN Seeks Enforcement of the Jury Instruction on the "converter for converting . . ." Claim Element.

These admissions by Apple's expert are fatal to a judgment of non-infringement for the "converter for converting . . ." claim element. Apple's non-infringement position requires that each group of input data symbols be *individually* separated, so that each individual data symbol from the group of data symbols is placed alone on its own parallel output path. The court, however, had analyzed Figures 1 and 4 in its *Markman* opinion and rejected placing any such *individual* separation limitation in the construction of the "converting . . ." phrase. A46-A49. Moreover, the court found that the "converter" term in the claim element is not limited to a serial-to-parallel converter and construed it as a "device that accepts data symbols in one form or mode and *changes the data symbols to another form or mode*." A44-A46 (emphasis added). This is further evidence that

the "converter for converting . . ." claim element does not require *individual* separation.

There is nothing in the claim language of "converting the first stream of data symbols into plural sets of N data symbols each" that requires "individual separation" or "even separation" of each group of N data symbols, once converted, as they are output from the converter. Consequently, if there are three data symbols in a group, they need *not* be individually separated, such that there is only one data symbol placed on each of three parallel output paths of the converter. A49; *see supra*, pp. 15-18.

The jury was instructed to decide infringement under the court's claim construction that omitted these limitations added by Apple's expert. A377, A706, A742, A745. The jury was *not* instructed to decide infringement under an "individual separation" (or Apple's repackaged "even separation") limitation. By allowing the jury to import Apple's additional limitations into the "converter for converting . . ." claim element, the court allowed the jury to modify the court's claim construction. This had the effect of fundamentally altering the verdict, because there is no dispute as to the structure and operation of the accused device. Accordingly, Apple's non-infringement defense for the "converter for converting . . ." claim element lacks any legal foundation on which a reasonable jury could return a verdict of non-infringement. *See Moba*, 325 F.3d at 1313-14 (holding that

claim construction is a question of law for the court, not the province of the jury, and that it was improper to allow the jury to add an additional limitation to the court's claim construction).

b. The Court Did Not Enforce the Jury Instruction for the "converter for converting . . ." Claim Element.

On JMOL, the issue is limited to the question of whether substantial evidence supported the verdict under the claim construction given to the jury. *Hewlett-Packard Co. v. Mustek Sys., Inc.*, 340 F.3d 1314, 1320 (Fed. Cir. 2003); *see also Moba*, 325 F.3d at 1313-14. In other words, it is too late at the JMOL stage to argue for or adopt a new and more detailed interpretation of the claim language and test the jury verdict by that new and more detailed interpretation. *Hewlett-Packard*, 340 F.3d at 1320. The verdict must be tested by the claim construction actually given to the jury. *Id*. Parties cannot reserve issues of claim construction for post-trial motions. *Id*. When issues of claim construction have not been properly raised in connection with the jury instructions, it is improper for the court to adopt a new or more detailed claim construction in connection with the JMOL motion. *Id*.

In its JMOL order, the court confirmed that it had previously rejected Apple's argument that each group must be separated into N *individual* data symbols when output from the converter:

> The argument that each group must be separated into N *individual* data symbols was previously rejected by the Court.

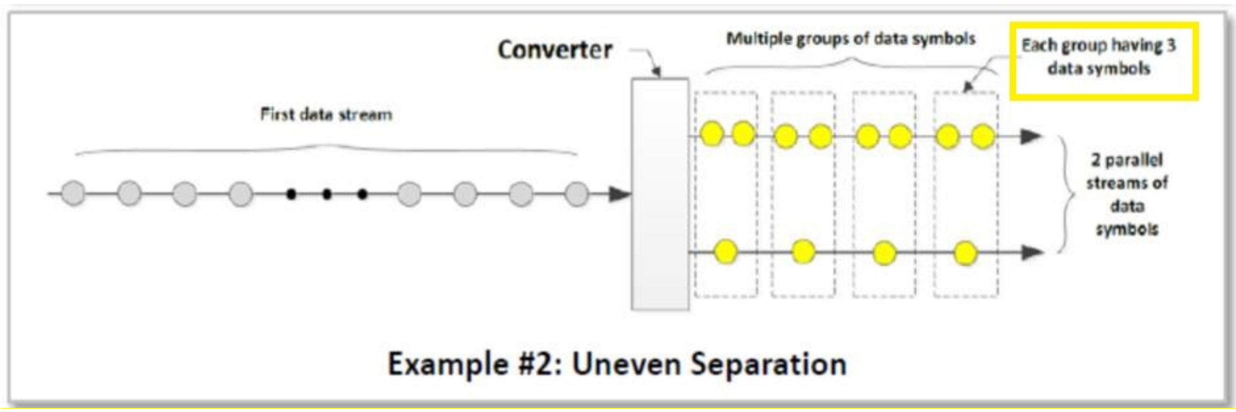
A12 (emphasis added). The only requirement for the converter found in the court's JMOL opinion is that it separates the incoming data symbols into groups, where each group has the same number of data symbols:

> However, the Court did not reject the notion that the data must be **evenly separated into multiple groups of N data symbols each**. Therefore, the number of *groups* of N data symbols does not have to equal N, although **each group must contain the *same N number* of data symbols.**

Id. (italics in original, bolding added). Neither Wi-LAN nor Apple disputed that each *group* of data symbols must contain the same number of data symbols. The court failed to recognize that Wi-LAN disputed Apple's interpretation in its testimony at trial that required that each data symbol in a group must appear on a separate output path. Wi-LAN's JMOL argument was thus not addressed by the court.

In rejecting Wi-LAN's JMOL motion, the court confused the number of data symbols in each group with the number of data symbols on each output path. Apple's "even separation" requirement (which recycled the "individual" separation requirement) pertained to the number of data symbols on each parallel output path, not the number of data symbols in a group. Apple did not dispute that the accused device "evenly separates" the input data symbols into *groups* containing the same

number of data symbols. In the context of Example #2, which corresponds to the accused device, each group has three data symbols, as labeled in the upper, right-hand corner.



While the number of data symbols in each group is equal, it does not follow from the actual claim language or the court's construction that the number of data symbols from the group on each parallel output path must be equal. In other words, as Apple's Example # 2 showed, for a group of three data symbols, two data symbols may be placed on one output path and the remaining data symbol may be placed on another output path. Thus, the "Uneven Separation" shown in Example #2 is included within the scope of the "converter for converting . . ." claim element, as construed by the court. The court erred when it refused to enforce the court's claim construction that the jury was instructed to use or otherwise modified its claim construction post-trial to import Apple's "individual" or "even" separation limitation into the element.

4. No Evidence Supports the Verdict of Non-Infringement under the Court's Construction of "Modulated Data Symbols."

The court properly construed the term "modulated data symbols" of the "means to combine" element to mean "data symbols that have been spread by a spreading code." A59-A62. The court held that randomization should not be imported into the term as a limitation, because "randomization is a desirable feature that is addressed by other claim language, such as the term 'invertible randomized spreading'. . . ." A62.

At trial, Apple argued a specific "order of the operations" construction, which was not raised by Apple during the *Markman* phase. Apple asserted that there is a temporal limitation in the apparatus claim requiring the randomizing and spreading operations to occur before the combining operation. The argued construction is critical to Apple's non-infringement defense because the accused device combines spread data symbols and then randomizes the combined data symbols.

Claim 1 below highlights the context in which the "modulated data symbols" language is used, and the associated means-plus-function claim terms, including the "means to combine the modulated data symbols:"

> 1. A transceiver for transmitting a first stream of data symbols, the transceiver comprising:
>
> a converter for converting the first stream of data symbols into plural sets of N data symbols each;

> *first computing means* for operating on the plural sets of N data symbols *to produce* ***__modulated data symbols__*** corresponding to an invertible ***__randomized__*** spreading of the first stream of data symbols; and
>
> *means to combine* ***the modulated data symbols*** for transmission.

A100 (emphasis added).

There is nothing in the recited function or the corresponding structure of the means-plus-function terms that denotes a sequential limitation.[14] In certain instances this Court has found a sequential limitation in an apparatus claim when both the written description and claim language impose a certain sequence of operation by including the temporal preposition "after." There is no such language here. *See Oak Tech., Inc. v. ITC*, 248 F.3d 1316, 1328-29 (Fed. Cir. 2001). There is nothing in claim 1 to indicate that combining must occur only after randomizing, nor is there any clear and unmistakable disclaimer requiring such order. Because these functions are part of the "first computing means" and "means to combine," the interpretation is controlled by 35 U.S.C. § 112, paragraph 6. Only the structure that is both necessary to perform and actually performs the recited functions is part of the corresponding structure that limits the claim. *Asyst Techs., Inc. v. Empak*,

[14] The court construed the corresponding structure for the "first computing means . . ." as "element 12 of Figures 1 and 4, columns 2:6-10, 2:36-40, 2:58-62, 4:2-12 and 4:35-44, and equivalents thereof." The court construed the corresponding structure for the "means to combine . . ." as "element 14 of Figures 1 and 4, column 4:5-7, and equivalents thereof." A73.

Inc., 268 F.3d 1364, 1370 (Fed. Cir. 2001) ("Structural features that do not actually perform the recited function do not constitute corresponding structure and thus do not serve as claim limitations."); *In re Teles AG Informationstechnologien*, 747 F.3d 1357, 1368 (Fed. Cir. 2014) ("The structure disclosed in the specification must be necessary to perform the function described in the claim."). The order of operations for the means-plus-function structures here is not necessary to perform (nor is it part of the structure that actually performs) the claimed functions.

The specification of the '802 patent states that "modulated data symbols" are data symbols that have been "spread . . . over a separate code symbol" and makes no mention of any requirement that the data symbols must be randomized before they are considered "modulated data symbols." A99. Additionally, neither the '802 patent nor its prosecution history puts any significance on the order of the combining and randomizing operations because those operations are linear mathematical processes that can be applied in any order without changing the outcome. This "linear" characteristic was acknowledged by both Wi-LAN's expert, A759-A762, A793, and Apple's expert, A1034, [redacted] A3025, A3113, and a prior art patent, A3552, A3564. *See supra*, pp. 27-28. Thus, persons of skill in this art would not read any specific order for performing the claimed randomizing and combining functions recited for the means-plus-function terms in claim 1.

This conclusion is also supported by intrinsic evidence in dependent claim 4, shown below, speaking to the sequence of the respective operations:

> 4. The transceiver of claim 1 in *which the first computing means comprises*:
>
> a *transformer* for operating on each set of N data symbols *to generate* ***modulated data symbols** as output, the modulated data symbols corresponding to* ***spreading*** of each data symbol over a separate code selected from a set of more than one and up to M codes, where M is the number of chips per code; and
>
> *means to combine* ***the modulated data symbols*** for transmission.

A101 (emphasis added).

Dependent claim 4 recites that the "modulated data symbols" are data symbols that are generated by spreading with the transformer structure of the first computing means ("the first computing means comprises: a transformer . . . to generate modulated data symbols . . . corresponding to spreading"), then combined by the "means to combine the modulated data symbols," and then randomized as in the accused device. Dependent claim 4 demonstrates that order does not matter in claim 1, because it places the "means to combine" between the spreading transform structure 20 of the "first computing means" (shown in Figure 4 as reference 20) for producing the modulated data symbols and the complex multiplier circuit of the first computing means for randomizing the modulated data

symbols (shown in Figure 8). Thus, Apple's proposed construction of "modulated data symbols" (which would impose an order of randomize first and then combine the modulated data symbols) cannot be reconciled with the intrinsic evidence presented by dependent claim 4. By claiming the location of the "means to combine" to be comprised within the "first computing means" in claim 4, the "means to combine" combines the modulated (spread, not randomized) data signals. Therefore, the complex randomizer in claim 1 may be placed after the "means to combine." If Apple's proposed construction were adopted, the only way to reconcile claims 1 and 4 would be to have two different meanings for the same phrase "modulated data symbols" within these two claims. *Rexnord Corp. v. Laitram Corp.*, 274 F.3d 1336, 1342 (Fed. Cir. 2001) ("[A] claim term should be construed consistently with its appearance in other places in the same claim or in other claims of the same patent."). The language of claim 1, in which the "corresponding to an invertible randomized spreading of the first stream of data symbols" phrase is not repeated in the "means to combine" element in claim 1, further supports the absence of a sequenced order requirement for the randomization operation.

a. Wi-LAN Seeks to Enforce the Jury Instruction on the "modulated data symbols" Claim Element.

Apple's expert testified that the "corresponding to. . ." claim language in the "first computing means" required that the "modulated data symbols" must be *both*

spread and randomized before being combined, even though the court's claim construction defined "modulated data symbols" only as "data symbols that have been spread by a spreading code." A62. Apple's expert admitted that his non-infringement opinion was facially inconsistent with the court's claim construction:

> Q. And the Court defined modulated data symbols in that claim term to be **data symbols that have been spread.**
>
> A. **That is correct.**
>
> ****
> Q. Okay. But **yet the way you're applying this claim, the combining means has to combine modulated data symbols that have been spread and randomized, right?**
>
> A. **That is correct.**

A1045 (emphasis added).

Consequently, Apple's expert contradicted the court's construction for the term "modulated data symbols," and his non-infringement opinion on this claim term directly contradicted the claim construction that the jury was instructed to apply. No reasonable jury, following the jury instructions and applying the court's construction for "modulated data symbols," could have reached a verdict of non-infringement. Therefore, Wi-LAN's JMOL motion should have been granted.

b. The Court Did Not Enforce the Jury Instruction for the "modulated data symbols" Claim Element.

In denying Wi-LAN's JMOL motion, the court recognized that "modulated data symbols" in the first computing means refers to data symbols that have been spread, not randomized. The court nonetheless found that the term "*the* modulated data symbols" appearing in the "means to combine" claim element refers to spread and randomized data symbols, notwithstanding that it is the same term "modulated data symbols" used in the "first computing means" and defined by the court. In the "means to combine" claim elements, the term "modulated data symbols" is preceded by the article "the," which denotes an antecedent basis for the term "modulated data symbols" as defined by the court to be *only* spread data symbols. *Baldwin Graphics Sys., Inc. v. Siebert, Inc.,* 512 F.3d 1338, 1342–43 (Fed. Cir. 2008).

The court found that Apple's expert "was entitled to give his opinion that from his study of the language in claim 1 and the Court's construction of certain terms, those particular modulated data symbols must be spread and randomized before being combined." A14. The court's JMOL ruling completely undermines the division of responsibilities laid out by the Supreme Court and this Court pertaining to claim construction, and allowed the expert and the jury to use a different construction for "modulated data symbols" than determined in the court's *Markman* phase and given to the jury to apply. That is reversible legal error.

Apple's expert admitted that the accused device spreads, randomizes, and combines as required by claim 1.

> Q. Just to get some foundation here, sir, **you don't dispute that all of the accused Apple products include a spreading, a randomization, and a combining, correct**?
>
> A. Well, if you take the Walsh covering to be spreading, **I would agree with that**.
>
> Q. Okay. Because the Walsh covering is the spreading code that's described for the preferred embodiment in the patent, right?
>
> A. It is.

A1045 (emphasis added).

Testimony presented at trial by Apple's expert regarding the "modulated data symbols" claim term was that claims 1 and 10 require randomizing the modulated data symbols *before* combining them. As shown above, however, the asserted claims do not require that the "modulated data symbols" must be randomized *before* being combined—they only require that the "modulated data symbols" be randomized at some point prior to transmission. Since there is no temporal limitation in the claim, the order of operations does not matter. By defining the term "modulated data symbols" for the jury as data symbols that have been "spread by a spreading code," the court made clear there is no temporal limitation in the claim and no specific order of operations. Since Apple never disputed (and Apple's expert admitted) that its accused device has corresponding

structure that spreads, randomizes, and combines the data symbols before transmission, A1045, there is no evidence to support a non-infringement verdict on this claim term, and JMOL should have been granted.

c. Wi-LAN Proved Infringement Under the Doctrine of Equivalents.

Even if the Court were to find a required sequence in the recited operations, Wi-LAN presented a doctrine of equivalents case at trial to show that the order of the randomizing and combining functions is insubstantially different, interchangeable, and equivalent regardless of whether the modulated data symbols were (1) randomized and then combined, or (2) combined and then randomized (as in the accused device). A759-A761. *Honeywell Int'l Inc. v. Hamilton Sundstrand Corp.*, 370 F.3d 1131, 1139 (Fed. Cir. 2004) (finding "'The doctrine of equivalents allows the patentee to claim those insubstantial alterations that were not captured in drafting the original patent claim but which could be created through trivial changes.' "*Festo*, 535 U.S. at 733, 122 S.Ct. 1831. An element in the accused device is equivalent to a claim limitation if the only differences between the two are insubstantial. *Eagle Comtronics, Inc. v. Arrow Communication Labs., Inc.*, 305 F.3d 1303, 1315 (Fed. Cir. 2002) (citing *Warner-Jenkinson*, 520 U.S. at 40, 117 S.Ct. 1040).").

Here, it is undisputed that the accused device uses structures performing the exact same mathematical operations to accomplish the spreading, randomizing and

combining recited in Claim 1. The ’802 patent teaches the use of a Walsh code transform to spread the data symbols. A100, A1045. The accused device (and the relevant industry standards) also uses a Walsh code transform to spread the data symbols. A1013, A1028, A1029, A1045. The ’802 patent teaches the use of a complex multiplier to randomize the data symbols. A85. The accused device (and the relevant industry standards) also uses a complex multiplier to randomize the data symbols. A1013, A1032, A1033, A1045. The ’802 patent teaches the use of a combiner to combine the data symbols. A99. The accused device (and the relevant industry standards) also uses a combiner to combine the data symbols. A1030, A1031, A1045.

Since the operations of combining and randomizing are linear, the sequence of those operations does not matter. Apple’s expert agreed with this fact, and

A3552, A3564, A3025, A3111-A3114. Apple’s only argument to the contrary is that by changing the sequence of operations, *twenty* fewer transistors are needed on the Qualcomm microchip that has *hundreds of millions of transistors* (less than *0.00002% difference*). A1034, A1053-A1054. This very slight modification constitutes an

insubstantial difference

CONFIDENTIAL MATERIAL REDACTED

C. Alternatively, A New Trial Should Be Granted.

The Fifth Circuit considers three factors—simplicity of the issues, extent to which the evidence is in dispute, and absence of any pernicious or undesirable occurrence at trial—as factors that weigh against granting a new trial. *See Shows v. Jamison Bedding, Inc.*, 671 F.2d 927, 930-31 (5th Cir. 1982).

Here, a new trial should have been granted. First**,** the issues of infringement were not "simple." Second, there were **no** fact disputes regarding the operation of the accused device and the only non-infringement defenses raised questions of law regarding claim limitations. Third, the jury was profoundly confused by Apple's arguments that applied limitations to the court's claims constructions that were rejected during Markman, and Apple's repeated characterizations of the '802 patent as a WiFi or LAN patent, not a cellular patent.

1. Apple's Only Non-Infringement Defenses Were Contrary to the Court's Claim Constructions and Jury Instructions.

Apple's only non-infringement defenses were based solely on arguments and testimony that added limitations to the court's claim constructions and to the constructions the jury was told to use. *See, supra*, pp. 37-60. Apple's non-infringement defense with respect to the "converter" limitation was contrary to the court's claim construction order, which rejected Apple's proposed construction

McKool 1012986v1

limiting the term to “individual” separation of the data symbols in each group. Apple’s non-infringement defense with respect to the term “modulated data symbols” was contrary to the court’s claim construction order, which rejected Apple’s proposed construction limiting the term “modulated data symbols” to require *both* spreading and randomizing. The great weight of the evidence establishes that under the claim constructions that the jury was instructed to apply, Apple infringes the ’802 patent.

Apple adopted a strategy of arguing claim limitations to the jury that either had not been raised, or had been explicitly rejected during the *Markman* phase and which the jury was never instructed to use. It is error for the court to allow the jury to consider disputes over claim scope. *See Sundance*, 550 F.3d at 1364 n.6. “[T]he risk of confusing the jury is high when experts opine on claim construction before the jury.” *Cytologix*, 424 F.3d at 1172. The court in its decision denying Wi-LAN’s JMOL motion stated: “The jury heard both sides’ interpretation of the claim language, considered the experts’ competing testimony, and rendered a verdict of no infringement.” A14. The court did not address and resolve the claim construction dispute, as required by this Court, choosing instead to leave the appropriate interpretation to the jury. If left unchecked, such an approach undermines the division of responsibilities outlined by the Supreme Court. *Markman*, 517 U.S. 370.

2. Apple Perniciously Argued That the '802 Patent Was Not a Cellular Patent.

Apple encouraged an improper verdict that is against the great weight of the evidence based on Apple's misrepresentations that the '802 patent is a WiFi or LAN-only patent, rather than on the relevant evidence and the claims as defined by the court for the jury. *See Whitehead*, 163 F.3d at 276. There is no restriction to the claim scope of the '802 patent based on a "WiFi" versus "cellular" argument. Further, during the *Markman* phase, Apple never attempted to restrict the claim scope of the '802 patent to exclude cellular transceivers. the parties agreed to construe a transceiver as "a device that transmits and receives data." A25. As a result, Apple waived any opportunity to limit the "transceiver" element to LAN (WiFi) or to exclude any application to "cellular." Apple instead improperly argued the LAN (WiFi) (not cellular) limitation directly to the jury throughout the trial by asking the jury to consider such things as plaintiff's name, Wi-LAN, as relevant evidence on Apple's cellular device's infringement of claims 1 and 10. A718-A719.

Apple encouraged the jury to commit error by improperly arguing and suggesting to the jury that the asserted claim scope could not cover cellular transceivers. Rather than join issue on the asserted claims of the '802 patent as construed by the court, Apple spent considerable trial time arguing that the '802 patent and its claims cover *only* LAN (WiFi) products, *not* cellular products.

Apple initiated this claim scope argument in its opening statement by arguing that Wi-LAN's inventions pertained only to LAN (WiFi) products, A718-A719, and continued to focus on its LAN (WiFi)-claim-scope argument throughout the trial. Apple argued in closing that the jury should limit the claim scope of the '802 patent because of Wi-LAN's name. If it is inappropriate to import limitations from the detailed description or even the title of a patent into the asserted claims, as this Court has held,[15] it is clearly inappropriate to import limitations from the *name* of the patentee, as Apple repeatedly urged the jury to do. *See, supra*, p. 25.

None of the testimony referenced above had anything to do with the language of the asserted claims of the '802 Patent. There is simply no basis to restrict the claim scope of claim 1 of the '802 patent to WiFi or LAN devices, and even Apple recognized that truth by declining to raise the issue during the *Markman* process. Moreover, Apple's expert testified that the asserted claims do not exclude cellular transceivers, that the patent could read on such a cellular device, and agreed that the WiFi/LAN versus cellular distinction made by Apple's counsel had nothing to do with what claim 1 covers. A1060. Apple continued to assert that the '802 patent is not a cellular patent, with only one possible purpose—

[15] *Pitney Bowes, Inc., v. Hewlett-Packard Co.*, 182 F.3d 1298, 1312 (Fed. Cir. 1999) ("[I]f we do not read limitations into the claims from the specifications that are not found in the claims themselves, then we certainly do not read limitations into the claims from the patent title.").

to confuse the jury as to the proper scope of the claims. Apple's "WiFi" versus "cellular" argument created juror confusion[16] and encouraged a verdict based not on analysis of the claim terms themselves but on a misconception fostered by Apple that the claims could not reach Apple's cellular products.

VII. CONCLUSION

Wi-LAN respectfully requests, based on the foregoing, that this Court reverse the court's decision denying Wi-LAN's JMOL on infringement and remand the case for a determination of damages. In the alternative, Wi-LAN requests that this Court reverse the court's decision denying Wi-LAN's motion for a new trial and remand the case for a new trial on infringement and damages.

[16] There is direct evidence that supports the jury confusion basis for granting Wi-LAN's motion for a new trial. After the jury was dismissed, one juror was interviewed and quoted in a publication as saying that Wi-LAN had not proved that the '802 patent was a cellular invention. http://www.milbank.com/images/content/1/4/14506/Scarsi-Litigator-of-the-Week.pdf ("The majority feeling was that Wi-LAN didn't prove to us that the patent was designed to be cellular," she said. "I searched for a way to fall for the plaintiff, but I just couldn't in the end.").

Respectfully submitted,

/s/ Robert A. Cote

Robert A. Cote
MCKOOL SMITH P.C.
1 Bryant Park
New York, NY 10036
(212) 402-9402

Samuel F. Baxter
MCKOOL SMITH P.C.
104 E. Houston Street, Suite 300
P.O. Box O
Marshall, TX 75670
(903) 923-9000

Rosemary Snider
R. Darryl Burke
Seth Hasenour
MCKOOL SMITH P.C.
300 Crescent Court, Suite 1500
Dallas, TX 78201
(214) 978-4000

Dirk D. Thomas
MCKOOL SMITH P.C.
1999 K Street, Suite 600
Washington, DC 20006
(202) 370-8302

Attorney for Plaintiff-Appellant

ADDENDUM

A1	Judgment dated October 25, 2013 [Dkt. 628]
A2-17	Memorandum Opinion and Order (JMOL) dated April 3, 2014 [Dkt. 649]
A18-74	Memorandum Opinion and Order (Markman) dated April 11, 2013 [Dkt. 302]
A75-103	U.S. Patent No. RE37,802 [Trial Exhibit PX-0002]

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

WI-LAN INC.,	§	
	§	
Plaintiff,	§	CASE NO. 2:11-CV-68-JRG
	§	
v.	§	**CONSOLIDATED WITH**
	§	
HTC CORP., et al.,	§	CASE NO. 2:12-cv-600-JRG
	§	
Defendants.	§	
	§	

JUDGMENT

A jury trial commenced in this case on October 15, 2013, and the jury reached and returned its unanimous verdict on October 23, 2013 (Dkt. No. 627). Pursuant to Rule 58 of the Federal Rules of Civil Procedure and in accordance with the jury's verdict and the entirety of the record available to the Court, the Court hereby **ORDERS AND ENTERS JUDGMENT** as follows:

1. Defendant Apple, Inc. ("Apple") does not directly infringe claims 1 or 10 of U.S. Patent No. RE37,802.

2. Claims 1 and 10 of U.S. Patent No. RE37,802 are invalid.

3. Pursuant to Rule 54(d) of the Federal Rules of Civil Procedure and 28 U.S.C. § 1920, the Court finds that Apple is the prevailing party in this matter and is entitled to costs consistent therewith.

4. All pending motions are hereby **DENIED**.

So ORDERED and SIGNED this 24th day of October, 2013.

RODNEY GILSTRAP
UNITED STATES DISTRICT JUDGE

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

WI-LAN INC.,	§	
	§	
Plaintiff,	§	
	§	
v.	§	CASE NO. 2:11-CV-68-JRG
	§	
HTC CORP., et al.,	§	**LEAD CASE**
	§	
Defendants.	§	
	§	

WI-LAN INC.,	§	
	§	
Plaintiff,	§	
	§	
v.	§	CASE NO. 2:12-CV-600-JRG
	§	
APPLE INC., et al.,	§	**Member Case**
	§	
Defendants.	§	
	§	

MEMORANDUM OPINION AND ORDER

I. INTRODUCTION

Before the Court is Wi-LAN Inc.'s ("Wi-LAN") Motion for Judgment as a Matter of Law Under FRCP 50(b) or, in the Alternative, Motion for a New Trial Under FRCP 59 (Dkt. No. 635). In it, Wi-LAN moves the Court to overturn the jury's verdict and find the asserted patent to be valid and to find that Apple Inc. ("Apple") infringes both of the asserted claims as a matter of law.

Wi-LAN filed this patent infringement action against Apple Inc. ("Apple") on February 2, 2011, accusing the iPhone and iPad devices of infringing claims 1 and 10 of U.S. Patent No. RE37,802 ("the '802 patent") by using certain industry standards in the field of wireless

technology. The Court held a seven-day jury trial beginning on October 15, 2013. The jury returned a unanimous verdict on October 23, 2013 finding that Apple does not infringe and that claims 1 and 10 of the ’802 patent are invalid. (*See* Jury Verdict, Dkt. No. 627.)

II. APPLICABLE LAW REGARDING RULE 50

Judgment as a matter of law is only appropriate when “a reasonable jury would not have a legally sufficient evidentiary basis to find for the party on that issue.” Fed. R. Civ. P. 50(a). “The grant or denial of a motion for judgment as a matter of law is a procedural issue not unique to patent law, reviewed under the law of the regional circuit in which the appeal from the district court would usually lie.” *Finisar Corp. v. DirectTV Group, Inc.*, 523 F.3d 1323, 1332 (Fed. Cir. 2008). The Fifth Circuit “uses the same standard to review the verdict that the district court used in first passing on the motion.” *Hiltgen v. Sumrall*, 47 F.3d 695, 699 (5th Cir. 1995). Thus, a jury verdict must be upheld, and judgment as a matter of law may not be granted, unless “there is no legally sufficient evidentiary basis for a reasonable jury to find as the jury did.” *Id.* at 700. The jury’s verdict must be supported by “substantial evidence” in support of each element of the claims. *Am. Home Assurance Co. v. United Space Alliance*, 378 F.3d 482, 487 (5th Cir. 2004).

A court reviews all evidence in the record and must draw all reasonable inferences in favor of the nonmoving party; however, a court may not make credibility determinations or weigh the evidence, as those are solely functions of the jury. *See Reeves v. Sanderson Plumbing Prods., Inc.*, 530 U.S. 133, 150-51 (2000). The moving party is entitled to judgment as a matter of law “only if the evidence points so strongly and so overwhelmingly in favor of the nonmoving party that no reasonable juror could return a contrary verdict.” *Int’l Ins. Co. v. RSR Corp.*, 426 F.3d 281, 296 (5th Cir. 2005).

III. APPLICABLE LAW REGARDING RULE 59

Under Rule 59(a) of the Federal Rules of Civil Procedure, a new trial can be granted to any party to a jury trial on any or all issues "for any reason for which a new trial has heretofore been granted in an action at law in federal court." Fed. R. Civ. P. 59(a). "A new trial may be granted, for example, if the district court finds the verdict is against the weight of the evidence, the damages awarded are excessive, the trial was unfair, or prejudicial error was committed in its course." *Smith v. Transworld Drilling Co.*, 773 F.2d 610, 612-13 (5th Cir. 1985). The Court must view the evidence "in a light most favorable to the jury's verdict, and [] the verdict must be affirmed unless the evidence points so strongly and overwhelmingly in favor of one party that the court believes that reasonable persons could not arrive at a contrary conclusion." *Dawson v. Wal-Mart Stores, Inc.*, 978 F.2d 205, 208 (5th Cir. 1992).

IV. JUDGMENT OF INVALIDITY

Wi-LAN's motion for judgment as a matter of law of no invalidity focuses on a specific means-plus-function claim limitation present in claims 1 and 10 of the '802 patent. The element at issue is: "first computing means for operating on the plural sets of N data symbols to produce modulated data symbols corresponding to an invertible randomized spreading of the first stream of data symbols."[1] Pursuant to the parties' agreement during the *Markman* hearing, the Court adopted the following function and corresponding structure.

Function: "operating on the plural sets of N data symbols to produce modulated data symbols corresponding to an invertible randomized spreading of the first stream of data symbols"	**Corresponding Structure:** "element 12 of Figures 1 and 4, columns 2:6-10, 2:36-40, 2:58-62, 4:2-12 and 4:35-44, and equivalents thereof"

[1] The parties both refer to both the means-plus-function limitations in the second element of claims 1 and 10 as "first computing means" in addressing this issue.

(*See* Claim Construction Order, Dkt. No. 302.)

In this motion, the parties dispute two distinct issues.

First, Wi-LAN generally contends that Apple presented insufficient evidence that the structure as construed by the Court exists in the prior art. Wi-LAN asserts that Apple's expert witness, Dr. Acampora, only performed half of the invalidity analysis in opining that this means-plus-function element was disclosed by the prior art because he only found the "invertible randomized spreading" function to be met, but omitted any discussion of a structural comparison. Wi-LAN argues that a purely functional analysis of a means-plus-function limitation is insufficient to establish invalidity as a matter of law. In response, Apple asserts that both a functional and structural comparison was conducted during trial. Apple identified two instances during Dr. Acampora's testimony where he demonstrated to the jury that the spread spectrum modulator structures (or its equivalents) were present in the Sasaki and Gilhousen prior art such that it satisfies the corresponding structure in the Court's claim construction.

Second, Wi-LAN asserts that a complex multiplier is a necessary part of the required structure of the "first computing means" element and any invalidity analysis is fatally incomplete if the prior art references do not disclose a complex multiplier. Apple disagrees, pointing out that the Court's construction does not specifically identify a complex multiplier as a corresponding structure. Therefore, this question turns on whether a complex multiplier is a necessary part of the structure corresponding to the "first computing means." If a complex multiplier is a required component, then the jury's invalidity verdict cannot survive because it is undisputed that no evidence was presented to the jury showing that a complex multiplier existed in the prior art.

i. *Apple presented sufficient evidence of corresponding structure*

The Court first evaluates whether Apple conducted a structural analysis of the means-plus-function element. In other words, whether Apple presented sufficient evidence that the prior art disclosed element 12 of Figures 1 and 4 or equivalents thereof—the corresponding structure as identified by the Court for the term "first computing means."

It is well-settled law that to prove anticipation of a means-plus-function limitation, a functional analysis alone will not suffice; the invalidity proponent must prove that the prior art discloses *both* the identical function and the particular corresponding structure that performs the function, or an equivalent thereof.[2] *Fresenius USA, Inc. v. Baxter Intern., Inc.*, 582 F.3d 1288, 1299 (Fed. Cir. 2009). "Just as a patentee who seeks to prove infringement must provide a structural analysis by demonstrating that the accused device has the identified corresponding structure or an equivalent structure, a challenger who seeks to demonstrate that a means-plus-function limitation was present in the prior art must prove that the corresponding structure—or an equivalent—was present in the prior art." *Id.* (citing *In re Donaldson Co.*, 16 F.3d 1339, 1361 (Fed. Cir. 1994)).

Apple points to three instances in the record where Dr. Acampora explained that the "spread spectrum modulators" structures performed the "first computing means" in the Sasaki and Gilhousen references. (10/21/2013 PM Tr. at 102:21-103:11, 106:23-107:3, 116:25-117:25). From a reading of the trial transcript, Dr. Acampora was not specifically asked to compare the "element 12 of Figures 1 and 4" structure to the Sasaki and Gilhousen prior art. However, the jury had the benefit of visual aids in the courtroom that was not captured by the written record. During his direct testimony on anticipation, Dr. Acampora referenced a slide presentation that clearly showed

---

2 Apple only put forth an invalidity case based on anticipation.

element 12 of Figure 1 from the ’802 patent (the corresponding structure) in a side-by-side comparison with images from both the Sasaki and Gilhousen prior art references. As a result, the record establishes that Dr. Acampora conducted both a functional and structural analysis of the means-plus-function element to find that the prior art reference is met.

In addition, a claim chart showing the Court’s construction and a copy of the ’802 patent was provided to each juror in their juror notebooks. The Court’s charge specifically referred to those documents in instructing the jury on how to evaluate the means-plus-function claims:

> I will now instruct you about the meaning of the means-plus-function claim requirement. Remember that the Court’s claim chart tells you the function that is performed and the structure disclosed in the ’802 patent specification that corresponds to that function. To establish literal infringement of a claim that includes means-plus-function requirements, Wi-LAN must prove two things:
> 1. the relevant structure in the accused device performs the <u>identical function</u> I identified in the claim construction chart found in your juror notebook, and
> 2. the accused device employs <u>a structure identical or equivalent to</u> the structure described in the patent.

(10/23/2013 AM Tr. at 42:21-43:10). Therefore, between the use of the visual presentation during Dr. Acampora’s testimony and the Court’s final instructions to the jury, the Court finds that Apple presented sufficient evidence that “element 12 of Figures 1 and 4,” the corresponding structure of the “first computing means,” was disclosed by the prior art.

ii. Complex multiplier is a required structure of “first computing means”

The Court next evaluates whether a complex multiplier is a required structure for “first computing means” based on the Court’s construction. Apple points out that the Court’s construction does not explicitly identify a complex multiplier as a structure corresponding to the means-plus-function term. The complex multiplier was disclosed in Figure 8 of the ’802 patent and the Court found the corresponding structure of “first computing means” to be “element 12 of

Figures 1 and 4, columns 2:6-10, 2:36-40, 2:58-62, 4:2-12 and 4:35-44, and equivalents thereof." Figure 8 was not included. Nevertheless, Wi-LAN argues that throughout the trial, both sides took the position that the complex multiplier found in Figure 8 was necessarily included in the Court's construction. As support for this argument, Wi-LAN relies on the direct examination testimony of Apple's expert witness, Dr. Acampora.

> Q. Okay. How many multipliers would be in the patent?
>
> A. Okay. So in the patent, we would have -- each of these would need to be a complex multiplier to perform invertible randomized spreading. **This is one of the structures that the Court identified as being that which corresponds to the first computing means.**

(10/21/2013 PM Tr. at 91:8-14). Further, Dr. Acampora agreed that the complex multiplier in Figure 8 is a part of the transforms that are in Figures 4 and 1, the Court-identified corresponding structure for the "first computing means."

> Q. Along with the randomizer transform. **Those transform -- the randomizer transform in Figure 8 is part of the transforms that are in Figure 4 and Figure 1 of the patent, correct?**
>
> A. **That is correct.**
>
> Q. Okay. Now, randomizing transform is a complex randomizer, right?
>
> A. It is.
>
> Q. The one in Figure 8 of the patent is a -- well, we call it sometimes a complex multiplier, right?
>
> A. That's correct.
>
> ****
>
> Q. Sir, when you were up here and sketching out on these drawings, didn't you tell the jury -- I wrote it down. You said that the randomizer transform is part of the Figure 1 first computing means.
>
> A. Yes.

> Q. And you said the randomizer transform is part of the Figure 4 first computing means.
>
> A. Yes.
>
> Q. And Sasaki does not use a randomizer transform of the type described in the ’802 patent, Figure 8, does it?
>
> A. That’s correct.
>
> Q. There’s only one randomizer transform in the ’802 patent that’s described, correct?
>
> A. There’s only one described. It’s Figure 8, which shows a bunch of complex multipliers.

(*Id.* at 139:12-22, 195:12-196:2). Dr. Acampora’s opinion is also consistent with the testimony from Wi-LAN’s expert witness, Dr. Orsak.

> Q. And it’s your opinion that the computing means of Claim 1 as described in Figure 1 requires Figures 3 and 8, correct?
>
> A. Those codes are specifically from Figure 3. That is correct. And Figure 3 must produce codes that spread and randomize in this case, and the only transform that performs randomization provided by the inventors is the randomizer transform, which is, as we just talked about, in Figure 8.

(Cross-examination 10/16/2013 AM Tr. at 91:12-20; *see also* direct examination of Dr. Orsak, 10/15/2013 PM Tr. at 34:2-37:21 (sealed)). Consequently, although the Court’s identification of the structure for “first computing means” does not specifically provide for a complex multiplier component, that does not mean a complex multiplier can never be a necessary component of the structure. Parties in patent cases often retain expert witnesses to explain and provide context to the claimed invention in a manner consistent with the Court’s constructions. That is exactly what happened here. The record reveals the expert witnesses from both sides agreed that complex multipliers *are a part of* the structure of “first computing means” as taught by

Case: 14-1437 Document: 30 Page: 86 Filed: 08/26/2014

the ’802 patent. Apple has not shown in its post-verdict briefing that its own expert’s trial testimony was inconsistent with the Court’s interpretation.

Each patent claim is presumed to be valid and as the party asserting invalidity, Apple was required to prove invalidity by clear and convincing evidence. 35 U.S. C. § 282; *Fresenius*, 582 F.3d at 1294-1295. Apple’s expert clearly testified that the complex multiplier shown in Figure 8 is a necessary part of the corresponding structure for “first computing means,” yet he failed to identify how this structure was disclosed by the prior art. As it is undisputed that no evidence was presented of complex multipliers in the prior art, Apple’s evidentiary burden of proof cannot be carried. The Court is unable to find that the jury’s finding as to invalidity of claims 1 and 10 of the ’802 patent is supported by substantial evidence. Accordingly, the jury’s invalidity verdict cannot stand.

V. JUDGMENT OF NON-INFRINGEMENT

Wi-LAN makes two arguments to show that it is entitled to a judgment of infringement as a matter of law. Both arguments are premised on Apple’s allegedly contradictory application of terms that have already been construed by the Court. Wi-LAN first contends that Apple improperly argued that “even” separation of the input “first data stream” is required at the output of the “converter” element in claims 1 and 10, which contradicts the Court’s construction of the term “converter.” Wi-LAN’s second argument relates to its non-infringement defenses for the “first computing means” and “means to combine.” Wi-LAN contends that Apple’s requirement that the “modulated data symbols” must be spread and randomized before being combined contradicts the Court’s claim construction, which does not specify such an order of operations.

i. Even separation

The first dispute centers on whether Apple properly applied the Court's claim construction to the "converter" element in setting forth its non-infringement position before the jury. The Court has construed the term "converting [the / a] first stream of data symbols into plural sets of N data symbols each" to mean "separating the first data stream into multiple groups of data symbols such that each group has N data symbols." In reaching this construction, the Court explained that it "reject[ed] Defendants' proposal that each group must be separated into N individual data symbols." (Dkt. No. 302 at 32.) From that statement, Wi-LAN contends the Court explicitly rejected Apple's "even separation" argument such that the groups of N input data symbols entering the converter need not be evenly separated into N individual data symbols at the output of the converter. However, Wi-LAN continues, Apple disregarded the Court's construction during trial by asserting that even separation was a necessary requirement to find infringement. According to Wi-LAN, Dr. Acampora (Apple's expert) inappropriately imported this additional limitation to the "converting…" term that required the number of streams coming out of the converter to equal the number of data symbols in each group.

In response, Apple contends that it never relied on an "equal data streams" limitations for its non-infringement position. Rather, Apple argues that Dr. Acampora's testimony made clear the reason the products do not meet the converting limitation is because they do not meet the "even separation" requirement. Apple maintains that the "even separation" requirement is consistent with the Court's construction because the *Markman* Order went on to explain that "the disputed term should be construed to clarify and explain that the stream of data symbols is separated into

multiple groups and that each group has N data symbols." (Dkt. No. 302 at 32.) The Court agrees with Apple.

The argument that each group must be separated into N individual data symbols was previously rejected by the Court. However, the Court did not reject the notion that the data must be evenly separated into multiple groups of N data symbols each. Therefore, the number of *groups* of N data symbols does not have to equal N, although each group must contain the *same N number* of data symbols. Dr. Acampora's testimony at trial was consistent with this construction.

During trial, Dr. Acampora testified that the three standards accused of infringement do not meet the converter limitation because they do not perform even separation. First, he explained the CDMA2000 standard has two channels, the fundamental channel and the supplemental channel. The CDMA2000 standard does not have the claimed converter because "these two channels have different numbers of data symbols." (10/21/2013 PM Tr. at 68:10-19.) Dr. Acampora next explained the EV-DO standard also does not do an equal split because "six symbols come in, two go to the top output, four go to the bottom output." (*Id.* at 73:3-20.) Dr. Acampora opines that the third accused standard, the HSUPA standard, similarly operates with an unequal split and does not use the claimed converter. (*Id.* at 75:2-76:13.) Wi-LAN has failed to persuade the Court that such testimony is inconsistent with the construction of the "converter" terms.

ii. Order of operations

The second dispute relates to Apple's non-infringement defenses for the elements "first computing means" and "means to combine" in asserted claims 1 and 10. Wi-LAN contends that Apple's defense was inappropriately premised on a specific order of operations such that the "means to combine" must combine "modulated data symbols" that have been both spread and

randomized before they are combined. The Court construed “modulated data symbols” to mean “data symbols that have been spread by a spreading code,” which only requires spreading. (Dkt. No. 302 at 45.) Therefore, according to Wi-LAN, by importing a randomization requirement into the Court’s construction, Apple is attempting to resurrect an argument that was explicitly rejected during claim construction.

Apple responds that it did not read a randomization requirement into the term “modulated data symbols” during trial. Instead, Apple contends that it relied on the antecedent basis of “*the* modulated data symbols” referenced in the “means to combine” limitation of claim 1. While not all modulated data symbols within the ’802 patent need to be randomized, Apple argues that *the* modulated data symbols that are being combined in the “means to combine” limitation requires the randomization to occur. The Court agrees with Apple.

The entirety of claim 1 of the ’802 patent reads as follows:

1. A transceiver for transmitting a first stream of data symbols, the transceiver comprising:
   a. a converter for converting the first stream of data symbols into plural sets of N data symbols each;
   b. first computing means for operating on the plural sets of N data symbols to produce **modulated data symbols** corresponding to an invertible randomized spreading of the first stream of data symbols; and
   c. means to combine *the* **modulated data symbols** for transmission.

The term, “modulated data symbols,” as construed, only requires spreading and does not require randomization because neither the specification nor the prosecution history contains any definitive statement or disclaimer mandating that “modulated data symbols” must be randomized. (Dkt. No. 302 at 44.) Therefore, any attempt by Apple to import a randomization requirement into this term would be improper. However, in the Markman opinion the Court also acknowledged that “randomization is a desirable feature that is addressed by other claim language, such as the term

Case: 14-1437 Document: 30 Page: 90 Filed: 08/29/2014

'invertible randomized spreading,' which also appears in Claim 1." (*Id.* at 45.) The interrelatedness of the terms within claim 1 was the reason the Court concluded that randomization "should not be imported into the term 'modulated data symbols.'" (*Id.*) Accordingly, Dr. Acampora did not contradict the Court's claim construction in explaining that "*the* modulated data symbols" in the third element of claim 1 refers back to the "modulated data symbols corresponding to an invertible randomized spreading," introduced in the second element of claim 1. As a qualified technical expert, Dr. Acampora was entitled to give his opinion that from his study of the language in claim 1 and the Court's constructions of certain terms, those particular modulated data symbols must be spread and randomized before being combined.

Wi-LAN also contends that dependent claim 4 confirms that Apple's interpretation of ordering is incorrect. The Court is not persuaded by an argument on claim construction raised for the first time in post-trial briefing.

In summary, a reasonable jury could have found (and did find) non-infringement under the Court's claim constructions under either of the above non-infringement defenses. Wi-LAN put on infringement testimony from its expert, Dr. Orsak, and had ample opportunity to cross-examine Dr. Acampora on each of Apple's non-infringement positions. The jury heard both sides' interpretation of the claim language, considered the experts' competing testimony, and rendered a verdict of no infringement. As is apparent from the verdict, the jury had reason to believe Dr. Acampora's testimony and disbelieve the opinions of Dr. Orsak. This Court may not supplant the jury's assignment of credibility or weight attributed as between the experts, as those are sole functions of the jury. Indeed, Wi-LAN has made no claim that the evidence supporting non-infringement presented at trial was insufficient, only that Apple's interpretation of the terms

conflicts with the Court's construction. Having determined that there is no inconsistency, the Court concludes that Wi-LAN has failed to meet its burden of persuasion on this issue and there is no cause to overturn the jury's verdict of non-infringement.

VI. WI-LAN'S ALTERNATIVE REQUEST FOR A NEW TRIAL

Pursuant to Fed. R. Civ. P. 59, Wi-LAN moves for a new trial with respect to issues of invalidity, infringement, and jury confusion. All of Wi-LAN's arguments, with the exception of jury confusion, rely on the same arguments as addressed above. Based on the same reasoning as already discussed, the Court disagrees with each of Wi-LAN's infringement arguments and does not find the verdict to be against the weight of the evidence. However, the Court will address the jury confusion argument.

Wi-LAN contends that Apple confused the jury by arguing that the asserted claims only cover Wifi/LAN products rather than cellular products; therefore, the verdict is against the great weight of the evidence. For support, Wi-LAN cites two things: (1) witnesses being asked whether the patent uses the term "cellular"; and (2) portions of Apple's opening and closing statements asserting that the '802 patent is not a cell phone patent.

With respect to the first point, it is Wi-LAN's burden to prove by a preponderance of the evidence that the accused standards infringe the '802 patent. If Apple presented evidence Wi-LAN disputes or finds improper, such as asking witnesses whether the patent includes the term "cellular," then the burden shifts to Wi-LAN to make an objection and, if the objection is overruled, cross-examine the witnesses on the correctness or relevance of such testimony. Here, Wi-LAN did not object to these questions during the course of the trial and has therefore waived any objection on the issue. *SSL Servs., LLC v. Citrix Sys., Inc.*, 940 F. Supp. 2d 480, 492 (E.D. Tex.

Apr. 17, 2013) ("SSL has waived any objection it might have had to the testimony presented at trial because it failed to object to such testimony during the direct examination at trial."). Additionally, Wi-LAN had a full and fair opportunity to cross-examine Apple's witnesses and elicit re-direct testimony of its own witnesses during trial after these questions were asked. It is improper to fail to object during trial while allegedly objectionable testimony is being presented and then wait until post-verdict briefing to ask for a new trial on the same basis.

Regarding the second point, Apple's arguments in opening and closing statements that the '802 patent is not a cell phone patent, the Court has repeatedly instructed the jury that opening and closing arguments are not evidence. On at least three occasions, the Court explained to the jury that what the lawyers say, including their opening and closing statements, are not evidence in this case. (10/15/2013 AM Tr. at 104:2-9; 10/15/2013 PM Tr. at 36:12-16; 10/23/2013 AM Tr. at 26:10-15.) Absent any actual evidence of jury confusion, the Court finds the jury was not confused by Apple's witness questioning on the term "cellular" or the opening or closing statements. Similarly, the Court does not find the verdict to be so against the great weight of the evidence as to warrant a new trial.

VII. CONCLUSION

Based on the foregoing, the Court **GRANTS-IN-PART** Wi-LAN's motion for judgment as a matter of law and finds that claims 1 and 10 of the '802 patent are not invalid. In all other respects, Wi-LAN's motion is **DENIED**. Accordingly, the Court hereby **VACATES** the portion of the Judgment (Dkt. No. 628) that found claims 1 and 10 of the '802 patent to be invalid.

So ORDERED and SIGNED this 2nd day of April, 2014.

RODNEY GILSTRAP
UNITED STATES DISTRICT JUDGE

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

WI-LAN INC.,	§	
	§	
Plaintiff,	§	
	§	
v.	§	CASE NO. 2:11-CV-68-JRG
	§	
HTC CORP., et al.,	§	
	§	
Defendants.	§	
	§	

MEMORANDUM OPINION AND ORDER

Before the Court are Plaintiff Wi-LAN Inc.'s Opening Claim Construction Brief (Dkt. No. 239), Defendants' response (Dkt. No. 257), and Plaintiff's reply (Dkt. No. 266).

The Court held a hearing on March 21, 2013.

Table of Contents

I. BACKGROUND **3**
II. LEGAL PRINCIPLES **3**
III. CONSTRUCTION OF AGREED TERMS **8**
IV. CONSTRUCTION OF DISPUTED TERMS IN THE '222 PATENT **9**
A. "transceiver" (Claims 1-3) 9
B. "amplitude and phase differential characteristics" and "the amplitude and the phase differential" (Claim 1) 10
C. "wideband frequency division multiplexer for multiplexing the information onto wideband frequency channels" (Claim 1) 11
D. "points" 17
E. "channel estimator for estimating one or both of the amplitude and the phase differential of the received signal to produce as output one or both of an estimated amplitude and an estimated phase differential respectively" (Claim 1) 18
F. "Fourier transform" (Claims 1 and 2), "processor for applying a Fourier transform to the multiplexed information to bring the information into the time domain for transmission" (Claim 1), and "deprocessor for applying an inverse Fourier transform to the samples output from the sampler" (Claim 2) 19
V. CONSTRUCTION OF DISPUTED TERMS IN THE '802 PATENT **26**
A. "converter" (Claim 1) 27
B. "converting [the / a] first stream of data symbols into plural sets of N data symbols each" (Claims 1 & 23) 29
C. "N" (Claims 1, 23 & 25) 32
D. "invertible randomized spreading" (Claims 1, 10 & 25) 39
E. "modulated data symbols" (Claims 1, 10, 12, 14, 15, 23, 25, 29 & 31) 42
F. "means for receiving a sequence of modulated data symbols, the modulated data symbols having been generated by invertible randomized spreading of a second stream of data symbols" (Claim 10) 45
G. "a set of more than one and up to M codes, where M is the number of chips per code" (Claims 12 & 23) and "more than one and up to M direct sequence spread spectrum codes" (Claim 23) 49
H. "means to apply diversity to the combined modulated data symbols before transmission" (Claim 15) 50
I. "first computing means for operating on the plural sets of N data symbols to produce modulated data symbols corresponding to an invertible randomized spreading of the first stream of data symbols" (Claim 1), "means to combine the modulated data symbols for transmission" (Claim 1), and "second computing means for operating on the sequence of modulated data symbols to produce an estimate of the second stream of data symbols" (Claim 10) 54
VI. CONCLUSION **56**

I. BACKGROUND

Plaintiff asserts United States Patents No. 5,282,222 ("the '222 Patent") and RE37,802 ("the '802 Patent") (collectively, the "patents-in-suit"). The '222 Patent, titled "Method and Apparatus for Multiple Access Between Transceivers in Wireless Communications Using OFDM Spread Spectrum," issued on January 25, 1994, and bears a priority date of March 31, 1992. The '802 Patent, titled "Multicode Direct Sequence Spread Spectrum," issued on July 23, 2002, from a reissue of United States Patent No. 5,555,268, which was a continuation-in-part of the '222 Patent. In general, the patents-in-suit relate to wideband orthogonal frequency-division multiplexing ("W-OFDM"), which is a communication technique for wireless networking.

The patents-in-suit were construed by Judge T. John Ward of this Court in a claim construction order and in a ruling on a motion for reconsideration. *WI-LAN, Inc. v. Acer, Inc.*, No. 2:07-CV-473-TJW, Dkt. No. 469 (E.D. Tex. May 11, 2010) ("*Acer*") (attached to Plaintiff's opening brief as Ex. C); *id.*, Dkt. No. 988 (E.D. Tex. Dec. 30, 2010) ("*Acer Reconsideration*") (attached to Plaintiff's opening brief as Ex. D). As Plaintiff notes, Defendants Apple Inc. ("Apple"), Dell Inc. ("Dell"), and Hewlett-Packard Co. ("HP") were also defendants in *Acer*.

II. LEGAL PRINCIPLES

It is understood that "[a] claim in a patent provides the metes and bounds of the right which the patent confers on the patentee to exclude others from making, using or selling the protected invention." *Burke, Inc. v. Bruno Indep. Living Aids, Inc.*, 183 F.3d 1334, 1340 (Fed. Cir. 1999). Claim construction is clearly an issue of law for the court to decide. *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 970-71 (Fed. Cir. 1995) (en banc), *aff'd*, 517 U.S. 370 (1996).

To ascertain the meaning of claims, courts look to three primary sources: the claims, the specification, and the prosecution history. *Markman*, 52 F.3d at 979. The specification must contain a written description of the invention that enables one of ordinary skill in the art to make and use the invention. *Id.* A patent's claims must be read in view of the specification, of which they are a part. *Id.* For claim construction purposes, the description may act as a sort of dictionary, which explains the invention and may define terms used in the claims. *Id.* "One purpose for examining the specification is to determine if the patentee has limited the scope of the claims." *Watts v. XL Sys., Inc.*, 232 F.3d 877, 882 (Fed. Cir. 2000).

Nonetheless, it is the function of the claims, not the specification, to set forth the limits of the patentee's invention. Otherwise, there would be no need for claims. *SRI Int'l v. Matsushita Elec. Corp.*, 775 F.2d 1107, 1121 (Fed. Cir. 1985) (en banc). The patentee is free to be his own lexicographer, but any special definition given to a word must be clearly set forth in the specification. *Intellicall, Inc. v. Phonometrics, Inc.*, 952 F.2d 1384, 1388 (Fed. Cir. 1992). Although the specification may indicate that certain embodiments are preferred, particular embodiments appearing in the specification will not be read into the claims when the claim language is broader than the embodiments. *Electro Med. Sys., S.A. v. Cooper Life Sciences, Inc.*, 34 F.3d 1048, 1054 (Fed. Cir. 1994).

This Court's claim construction analysis is substantially guided by the Federal Circuit's decision in *Phillips v. AWH Corporation*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). In *Phillips*, the court set forth several guideposts that courts should follow when construing claims. In particular, the court reiterated that "the claims of a patent define the invention to which the patentee is entitled the right to exclude." 415 F.3d at 1312 (quoting *Innova/Pure Water, Inc. v. Safari Water Filtration Sys., Inc.*, 381 F.3d 1111, 1115 (Fed. Cir. 2004)). To that end, the words

Case: 14-1437 Document: 30 Page: 98 Filed: 08/29/2014

used in a claim are generally given their ordinary and customary meaning. *Id.* The ordinary and customary meaning of a claim term "is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention, i.e., as of the effective filing date of the patent application." *Id.* at 1313. This principle of patent law flows naturally from the recognition that inventors are usually persons who are skilled in the field of the invention and that patents are addressed to, and intended to be read by, others skilled in the particular art. *Id.*

Despite the importance of claim terms, *Phillips* made clear that "the person of ordinary skill in the art is deemed to read the claim term not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent, including the specification." *Id.* Although the claims themselves may provide guidance as to the meaning of particular terms, those terms are part of "a fully integrated written instrument." *Id.* at 1315 (quoting *Markman*, 52 F.3d at 978). Thus, the *Phillips* court emphasized the specification as being the primary basis for construing the claims. *Id.* at 1314-17. As the Supreme Court stated long ago, "in case of doubt or ambiguity it is proper in all cases to refer back to the descriptive portions of the specification to aid in solving the doubt or in ascertaining the true intent and meaning of the language employed in the claims." *Bates v. Coe*, 98 U.S. 31, 38 (1878). In addressing the role of the specification, the *Phillips* court quoted with approval its earlier observations from *Renishaw PLC v. Marposs Societa' per Azioni*, 158 F.3d 1243, 1250 (Fed. Cir. 1998):

> Ultimately, the interpretation to be given a term can only be determined and confirmed with a full understanding of what the inventors actually invented and intended to envelop with the claim. The construction that stays true to the claim language and most naturally aligns with the patent's description of the invention will be, in the end, the correct construction.

Phillips, 415 F.3d at 1316. Consequently, *Phillips* emphasized the important role the specification plays in the claim construction process.

Case: 14-1437 Document: 30 Page: 99 Filed: 08/29/2014

The prosecution history also continues to play an important role in claim interpretation. Like the specification, the prosecution history helps to demonstrate how the inventor and the Patent and Trademark Office ("PTO") understood the patent. *Id.* at 1317. Because the file history, however, "represents an ongoing negotiation between the PTO and the applicant," it may lack the clarity of the specification and thus be less useful in claim construction proceedings. *Id.* Nevertheless, the prosecution history is intrinsic evidence that is relevant to the determination of how the inventor understood the invention and whether the inventor limited the invention during prosecution by narrowing the scope of the claims. *Id.*; *see Microsoft Corp. v. Multi-Tech Sys., Inc.*, 357 F.3d 1340, 1350 (Fed. Cir. 2004) (noting that "a patentee's statements during prosecution, whether relied on by the examiner or not, are relevant to claim interpretation").

Phillips rejected any claim construction approach that sacrificed the intrinsic record in favor of extrinsic evidence, such as dictionary definitions or expert testimony. The *en banc* court condemned the suggestion made by *Texas Digital Systems, Inc. v. Telegenix, Inc.*, 308 F.3d 1193 (Fed. Cir. 2002), that a court should discern the ordinary meaning of the claim terms (through dictionaries or otherwise) before resorting to the specification for certain limited purposes. *Phillips*, 415 F.3d at 1319-24. According to *Phillips*, reliance on dictionary definitions at the expense of the specification had the effect of "focus[ing] the inquiry on the abstract meaning of words rather than on the meaning of claim terms within the context of the patent." *Id.* at 1321. *Phillips* emphasized that the patent system is based on the proposition that the claims cover only the invented subject matter. *Id.*

Phillips does not preclude all uses of dictionaries in claim construction proceedings. Instead, the court assigned dictionaries a role subordinate to the intrinsic record. In doing so, the court emphasized that claim construction issues are not resolved by any magic formula. The

Case: 14-1437 Document: 30 Page: 100 Filed: 08/29/2014

court did not impose any particular sequence of steps for a court to follow when it considers disputed claim language. *Id.* at 1323-25. Rather, *Phillips* held that a court must attach the appropriate weight to the intrinsic sources offered in support of a proposed claim construction, bearing in mind the general rule that the claims measure the scope of the patent grant.

Indefiniteness is a "legal conclusion that is drawn from the court's performance of its duty as the construer of patent claims." *Exxon Research & Eng'g Co. v. United States*, 265 F.3d 1371, 1376 (Fed. Cir. 2001) (citation omitted). A finding of indefiniteness must overcome the statutory presumption of validity. *See* 35 U.S.C. § 282. That is, the "standard [for finding indefiniteness] is met where an accused infringer shows by clear and convincing evidence that a skilled artisan could not discern the boundaries of the claim based on the claim language, the specification, and the prosecution history, as well as her knowledge of the relevant art area." *Halliburton Energy Servs., Inc. v. M-I LLC*, 514 F.3d 1244, 1249-50 (Fed. Cir. 2008).

> In determining whether that standard is met, i.e., whether the claims at issue are sufficiently precise to permit a potential competitor to determine whether or not he is infringing, we have not held that a claim is indefinite merely because it poses a difficult issue of claim construction. We engage in claim construction every day, and cases frequently present close questions of claim construction on which expert witnesses, trial courts, and even the judges of this court may disagree. Under a broad concept of indefiniteness, all but the clearest claim construction issues could be regarded as giving rise to invalidating indefiniteness in the claims at issue. But we have not adopted that approach to the law of indefiniteness. We have not insisted that claims be plain on their face in order to avoid condemnation for indefiniteness; rather, what we have asked is that the claims be amenable to construction, however difficult that task may be. If a claim is insolubly ambiguous, and no narrowing construction can properly be adopted, we have held the claim indefinite. If the meaning of the claim is discernible, even though the task may be formidable and the conclusion may be one over which reasonable persons will disagree, we have held the claim sufficiently clear to avoid invalidity on indefiniteness grounds. . . . By finding claims indefinite only if reasonable efforts at claim construction prove futile, we accord respect to the statutory presumption of patent validity . . . and we protect the inventive contribution of patentees, even when the drafting of their patents has been less than ideal.

Exxon, 265 F.3d at 1375 (citations and internal quotation marks omitted).

In general, prior claim construction proceedings involving the same patents-in-suit are "entitled to reasoned deference under the broad principals of *stare decisis* and the goals articulated by the Supreme Court in *Markman*, even though *stare decisis* may not be applicable *per se*." *Maurice Mitchell Innovations, LP v. Intel Corp.*, No. 2:04-CV-450, 2006 WL 1751779, at *4 (E.D. Tex. June 21, 2006).

III. CONSTRUCTION OF AGREED TERMS

The Court hereby adopts the following agreed constructions:

United States Patent No. 5,282,222	
<u>Term</u>	<u>Agreed Construction</u>
"wideband frequency channels"	"frequency channels with a K (number of points) and a Δf (frequency band) large enough to be able to achieve a specific throughput and large enough to be able to avoid using either a clock or a carrier recovery device without substantially affecting the BER (bit error rate)"
"carrier recovery"	"process of determining the carrier phase of the received signal"
"clock recovery"	"process of determining the clock of the received signal"
United States Patent No. RE37,802	
<u>Term</u>	<u>Agreed Construction</u>
"transceiver"	"a device that transmits and receives data"
"spreading"	"distributing data symbols over codes to create a wider bandwidth of data symbols"
"direct sequence spread spectrum codes"	"pseudo random codes over which information bits are spread"

(Dkt. No. 197, 12/10/2012 Joint Claim Construction and Prehearing Statement, at 2-3.)

IV. CONSTRUCTION OF DISPUTED TERMS IN THE '222 PATENT

The Abstract of the '222 Patent states:

> A method for allowing a number of wireless transceivers to exchange information (data, voice or video) with each other. A first frame of information is multiplexed over a number of wideband frequency bands at a first transceiver, and the information transmitted to a second transceiver. The information is received and processed at the second transceiver. The information is differentially encoded using phase shift keying. In addition, after a pre-selected time interval, the first transceiver may transmit again. During the preselected time interval, the second transceiver may exchange information with another transceiver in a time duplex fashion. The processing of the signal at the second transceiver may include estimating the phase differential of the transmitted signal and pre-distorting the transmitted signal. A transceiver includes an encoder for encoding information, a wideband frequency division multiplexer for multiplexing the information onto wideband frequency voice channels, and a local oscillator for upconverting the multiplexed information. The apparatus may include a processor for applying a Fourier transform to the multiplexed information to bring the information into the time domain for transmission.

A. "transceiver" (Claims 1-3)

Plaintiff's Proposed Construction	Defendants' Proposed Construction
"a device that transmits and receives data"	"a device that transmits and receives data without the use of clock recovery, carrier recovery, automatic gain control, passband limiter, power amplifier, an equalizer, and an interleaver-deinterleaver"

(Dkt. No. 197, 12/10/2012 Joint Claim Construction and Prehearing Statement, Ex. A as to '222 Patent, at 1; *id.*, Ex. B, at 1.)

After the close of briefing, the parties reached agreement that the term **"transceiver"** in the '222 Patent should be construed to mean **"a device that transmits and receives data,"** as reflected in the parties' March 7, 2013 P.R. 4-5(d) Joint Claim Construction Chart. (*See* Dkt. No. 285.) The Court hereby adopts the parties' agreed construction.

B. "amplitude and phase differential characteristics" and "the amplitude and the phase differential" (Claim 1)

"amplitude and phase differential characteristics" (Claim 1)	
Plaintiff's Proposed Construction	**Defendants' Proposed Construction**
"characteristics of both the amplitude and the difference in phase caused by the wireless channel"	"This phrase is a limitation of the claim" and means "characteristics of both the amplitude and the difference in phase resulting from differential modulation of the received data signals."
"the amplitude and the phase differential" (Claim 1)	
Plaintiff's Proposed Construction	**Defendants' Proposed Construction**
"amplitude and difference in phase caused by the wireless channel"	"the amplitude and the difference in phase resulting from differential modulation of the received data signals"

(Dkt. No. 197, 12/10/2012 Joint Claim Construction and Prehearing Statement, Ex. A as to '222 Patent, at 1 & 2; *id.*, Ex. B, at 1.)

After the close of briefing, the parties reached agreement, as reflected in the parties' March 7, 2013 P.R. 4-5(d) Joint Claim Construction Chart (*see* Dkt. No. 285), that the following constructions should be adopted:

Term	Construction
"amplitude and phase differential characteristics"	**"characteristics of both the amplitude and the difference in phase caused by the wireless channel"**
"the amplitude and the phase differential"	**"amplitude and difference in phase caused by the wireless channel"**
"an estimated amplitude and an estimated phase differential"	**"an estimated amplitude and an estimated difference in phase caused by the wireless channel"**

The Court hereby adopts the parties' agreed constructions.

C. "wideband frequency division multiplexer for multiplexing the information onto wideband frequency channels" (Claim 1)

Plaintiff's Proposed Construction	Defendants' Proposed Construction
"a device that combines the information from multiple inputs into a single output for multiplexing the information onto wideband frequency channels"	"device that employs differential modulation to combine the information from multiple inputs into a single output for multiplexing the information onto wideband frequency channels" Alternative: Indefinite

(Dkt. No. 197, 12/10/2012 Joint Claim Construction and Prehearing Statement, Ex. A as to '222 Patent, at 3; *id.*, Ex. B, at 1.)

(1) The Parties' Positions

Plaintiff submits that it proposes the construction reached in *Acer*, and Plaintiff argues that "Defendants seek to import 'differential modulation' into 'wideband frequency division multiplexer' . . . .'" (Dkt. No. 239, at 10.) Plaintiff also highlights the disclosure of alternatives to differential modulation, such as quadrature amplitude modulation. (*Id.* at 8.) Further, Plaintiff urges that "the teachings in the '222 patent for W-OFDM are applicable to both differential and non-differential modulation/encoding schemes." (*Id.*) Finally, Plaintiff argues that "Defendants' suggestion, in the alternative, that the claim term is indefinite, lacks sufficient foundation, since the *Acer* Court previously had no difficulty construing the term, thereby establishing that it is in fact 'amenable to construction.'" (*Id.*, at 11 (quoting *Exxon*, 265 F.3d at 1375).)

Defendants respond that "'wideband frequency division multiplexer' is a term of art coined by the patentees" and therefore "must be construed as a whole consistent with its definition in the specification." (Dkt. No. 237, at 3.) As to Plaintiff's reliance on disclosure of quadrature amplitude modulation, Defendants respond that the disclosed modulator uses "DPSK (*differential* phase shift keying) symbols or DQAM (*differential* quadrature amplitude

modulated) symbols." (*Id.*, at 4 (citing '222 Patent at 5:30-34 & 9:26-28).) Defendants also argue that the only guidance for determining values for K and Δf are "for systems employing MDPSK (multilevel differential phase shift keying), a form of differential modulation." (*Id.*, at 5 (citing '222 Patent at 6:34-7:10).) Defendants conclude that "[t]he patentee's failure to disclose any standard to determine the values of K and Δf for non-differential modulation necessarily means that, if the claims are construed to cover non-differential modulation as [Plaintiff] suggests, a person of ordinary skill in the art would not be able to ascertain the scope of the invention," and the claims would therefore be invalid as indefinite. (*Id.*, at 5-6.)

Plaintiff replies that *Acer* properly rejected the argument that the specification discloses only differential modulation. (Dkt. No. 266, at 2.) Plaintiff also notes that the disputed term "does not include a 'modulation' term, let alone 'differential modulation.'" (*Id.*, at 3.) As to indefiniteness, Plaintiff reiterates that previous defendants, as well as the Court in *Acer*, were able to construe the disputed term. (*Id.*)

At the March 21, 2013 hearing, Defendants emphasized that *Acer* did not consider Defendants' present argument that for determining values for K and Δf, the specification only provides guidance with regard to differential modulation. Defendants also submitted that to the extent the disputed term is construed to encompass non-differential modulation, Defendants' invalidity argument is not so much one of indefiniteness but rather is really one of lack of enablement. As a matter of claim construction, however, Defendants urged that the scope of the claims should be limited by the scope of disclosure. *See On Demand Machine Corp. v. Ingram Indus., Inc.*, 442 F.3d 1331, 1340 (Fed. Cir. 2006) ("[T]he claims cannot be of broader scope than the invention that is set forth in the specification."); *see also Phillips*, 415 F.3d at 1416; *Retractable Techs., Inc. v. Becton, Dickinson & Co.*, 653 F.3d 1296, 1305 (Fed. Cir. 2011) ("In

reviewing the intrinsic record to construe the claims, we strive to capture the scope of the actual invention, rather than strictly limit the scope of claims to disclosed embodiments or allow the claim language to become divorced from what the specification conveys is the invention.”).

(2) Analysis

In non-differential modulation schemes, sequential data symbols themselves carry the information that is being transmitted or received. In differential modulation schemes, the *difference* between adjacent symbols is used to carry the information. (*See, e.g.,* Dkt. No. 257 at 4 n.3.) The parties disagree on whether the disputed term requires differential modulation and, if not, whether the disputed term renders the claim invalid.

In *Acer*, the Court found that “the terms ‘multiplexer’ and ‘multiplexing’ are well known in the art.” *Acer* at 21. The Court also found that “one of ordinary skill in the art would understand, in general, orthogonal frequency-division multiplexing as a type of frequency division multiplexing where a number of sub-carriers are used to carry data, wherein the data is divided into several parallel data streams or channels, one for each sub-carrier.” *Id.* at 22. *Acer* did not address whether the disputed term requires differential modulation.

Claim 1 of the ‘222 Patent recites (emphasis added):

> 1. A transceiver including a transmitter for transmitting electromagnetic signals and a receiver for receiving electromagnetic signals having amplitude and phase differential characteristics, the transmitter comprising:
> an encoder for encoding information;
> *a wideband frequency division multiplexer [f]or multiplexing the information onto wideband frequency channels*;
> a low pass filter;
> a local oscillator for upconverting the multiplexed information for transmission;
> a processor for applying a [F]ourier transform to the multiplexed information to bring the information into the time domain for transmission;
> further including, in the receiver of the transceiver[:]
> a bandpass filter for filtering the received electromagnetic signals;

a local oscillator for downconverting the received electromagnetic signals to produce output;

a sampler for sampling the output of the local oscillator to produce sampled signals to the channel estimator;

a channel estimator for estimating one or both of *the amplitude and the phase differential of the received signals* to produce as output one or both of *an estimated amplitude and an estimated phase differential* respectively; and

a decoder for producing signals from the sampled signals and the output from the channel estimator.

The parties have agreed that "wireless frequency channels" means: "frequency channels with a K (number of points) and a Δf (frequency band) large enough to be able to achieve a specific throughput and large enough to be able to avoid using either a clock or a carrier recovery device without substantially affecting the BER (bit error rate)." (Dkt. No. 197, 12/10/2012 Joint Claim Construction and Prehearing Statement, at 2-3.)

The specification repeatedly refers to differential modulation:

> The frequency bands are selected to occupy a wideband and are preferably contiguous, with the information being *differentially encoded* using phase shift keying.

('222 Patent at 2:63-64 (emphasis added).)

> In this disclosure there will be described two systems as examples of the implementation of the invention. The system described first here will apply to a cellular system with a number of portable transceivers and base stations (BS). Then will be described a local area network implementation.

(*Id.* at 4:64-5:1.)

> Wideband in this patent document is described in the context of Wideband-Orthogonal Frequency Domain Modulation (W-OFDM or wideband OFDM). In OFDM, the entire available bandwidth B is divided into a number of points K, where adjacent points are separated by a frequency band Δf, that is B=KΔf. The K points are grouped into a frame of K_1 points and two tail slots of K_2 points each, so that $K=K_1+2K_2$. The frame carries the information intended for transmission under the form of multilevel *differential* phase shift keying (MDPSK) symbols or differential quadrature amplitude modulated (DQAM) symbols.

(*Id.* at 5:24-34 (emphasis added).)

In summary, OFDM with a K and a Δf large enough to be able to achieve a specific throughput and large enough to be able to avoid using either a clock or a carrier recovery device without substantially affecting the BER is referred to here as Wideband-OFDM.

As an example, let us assume that *MDPSK* is used in an OFDM system with the number M of levels, with a carrier frequency f_c, with a raised cosine pulse of roll-off β, with the LO [(local oscillator)] at the receiver having a frequency offset f_o relative to the LO at the transmitter (so that the frequency offset between the carrier frequencies in the first and second transceivers of the multiplexed information is f_o), with a given maximum expected clock error $\tau=\chi T$ at the receiving transceiver, where T is the duration of one time domain sample, and with a maximum expected relative velocity V between the transceivers. Thus, in order to ensure that the out-of-band signal is ydB or less relative to the in-band signal and to be able to avoid using either a clock or a carrier recovery device without substantially affecting the BER we have to:

1. Find the acceptable sampling error $\Delta f'$, relative to one symbol sample, which does not substantially affect the BER. This can be done using the following rules:

$$\text{When } 0.2 \leq \beta \leq 0.3, \Delta f' = 7.50\%$$

$$\text{When } 0.3 \leq \beta \leq 0.4, \Delta f' = 10.0\%$$

$$\text{When } 0.4 \leq \beta \leq 0.5, \Delta f' = 12.5\%$$

$$\text{When } 0.5 \leq \beta \leq 0.6, \Delta f' = 15.0\%$$

2. Find Δf such that:

$$V/(\lambda \Delta f) + f_o/\Delta f \leq \Delta f'$$

3. Find K_2 such that

$$20.\log_{10}|P(f)/P(0)| \leq y \text{ for } f \geq \mathrm{K}_{2\sigma\mathrm{f}}$$

4. Find K_1 such that

$$2\pi\chi/\mathrm{K}_1 < \pi/\mathrm{M}$$

In this case, we refer to OFDM as Wideband-OFDM. Element 4 is a necessary condition for wideband OFDM, and given a sampling error, the sampling error may be corrected with the methods described in this patent document.

To implement wideband modulation, Orthogonal Frequency Division Multiplexing (OFDM) is preferred in which the information, for example encoded speech, is multiplexed over a number of contiguous frequency bands. Wideband OFDM forces the channel to be frequency selective and causes two types of linear

> distortion: amplitude distortion and phase distortion. To reduce the effect of amplitude distortion the modulation is preferably *phase modulation*, while the effect of phase distortion is reduced by employing *differential phase modulation*. Hence the modulation may be referred to as *Differential OFDM (DOFDM)*. Unlike in other proposed schemes, neither pilot tones nor diversity are required in DOFDM. Possibly, quadrature amplitude modulation might be used, but amplitude modulation makes it difficult to equalize the distorting effects of the channel on the signal.

(*Id.* at 6:30-7:27 (emphasis added).)

> The bits are provided to the modulator 512 which turns them into D8PSK symbols, with three bits per symbol.

(*Id.* at 9:26-28 ("D8PSK" refers to a particular differentially-modulated form of phase shift keying, *see id.* at 7:33-38).)

> For wireless LAN, *wideband differential orthogonal frequency division multiplexing* is again employed.

(*Id.* at 17:11-12 (emphasis added).)

The disputed term, however, does not refer to differential modulation, and the claim does not suggest that the use of differential modulation as opposed to non-differential modulation is of any relevant consequence. Claim 1 refers to the "amplitude and the phase differential of the received signals," but as discussed in the *Acer Reconsideration*, and as now agreed upon by the parties here (*see* Section IV.B., above), those recited "differentials" are properties of the communication channel rather than of the modulation technique. *See Acer Reconsideration* at 5-10. Further, the illustration of "D8PSK" ("Differential Eight Phase Shift Keying," *see* '222 Patent at 7:33-38) in Figures 5a, 5b, 13a & 13b does not demand that all embodiments must use differential modulation. *See MBO Labs., Inc. v. Becton, Dickinson & Co.*, 474 F.3d 1323, 1333 (Fed. Cir. 2007) (noting that "patent coverage is not necessarily limited to inventions that look like the ones in the figures"). On balance, the use of differential modulation is a feature of

Case: 14-1437 Document: 30 Page: 110 Filed: 08/25/2014

preferred embodiments and should not be imported into the disputed term here at issue. *Electro Med.*, 34 F.3d at 1054.

Finally, as to Defendants' indefiniteness argument, although the claims must be construed in light of the specification, the adequacy of the patent disclosure is generally an issue of validity, not claim construction. *Phillips*, 415 F.3d at 1327 ("[W]e have certainly not endorsed a regime in which validity analysis is a regular component of claim construction."). Defendants appeared to acknowledge as much at the March 21, 2013 hearing and have failed to meet their burden to demonstrate that the disputed term is not "amenable to construction." *Exxon*, 265 F.3d at 1375.

The Court therefore hereby construes **"wideband frequency division multiplexer for multiplexing the information onto wideband frequency channels"** to mean **"a device that combines the information from multiple inputs into a single output for multiplexing the information onto wideband frequency channels."**

D. "points"

Plaintiff's Proposed Construction	Defendants' Proposed Construction
"divisions of a wideband frequency channel" Alternatively: "sub-carriers"	"divisions within the frequency band"

(Dkt. No. 197, 12/10/2012 Joint Claim Construction and Prehearing Statement, Ex. A as to '222 Patent, at 3; *id.*, Ex. B, at 1; Dkt. No. 239, at 13.)

The term "points" is not found in the language of the asserted claims. The term appears within the agreed construction of "wideband frequency channels," which is set forth in Section III., above.

Case: 14-1437 Document: 30 Page: 111 Filed: 08/29/2014

After the close of briefing, the parties reached agreement that the term **"points"** should be construed to mean **"divisions of a frequency channel,"** as reflected in the parties' March 7, 2013 P.R. 4-5(d) Joint Claim Construction Chart. (*See* Dkt. No. 285.) The Court hereby adopts the parties' agreed construction.

E. "channel estimator for estimating one or both of the amplitude and the phase differential of the received signal to produce as output one or both of an estimated amplitude and an estimated phase differential respectively" (Claim 1)

Plaintiff's Proposed Construction	Defendants' Proposed Construction
The term "channel estimator" means "a device that estimates the effect of the channel on the transmitted signals." Apart from the construction of "channel estimator" and the "amplitude" and "phase differential" terms, further construction is not necessary. This limitation is not governed by § 112(6).	Means-plus-function under 35 U.S.C. § 112, ¶ 6 Function: "estimating one or both of the amplitude and the phase differential of the received signals to produce as output one or both of an estimated amplitude and an estimated phase differential respectively" Corresponding Structure: "the schematic shown in Figs. 7a and 15 and the algorithm as described in Fig. 7b and col. 10:57-col. 12:12"

(Dkt. No. 197, 12/10/2012 Joint Claim Construction and Prehearing Statement, Ex. A as to '222 Patent, at 4-5; *id.*, Ex. B, at 2-3.)

At the March 21, 2013 hearing, the parties agreed that the disputed term is not governed by 35 U.S.C. § 112, ¶ 6 and that the Court should construe the term to have its plain meaning.

The Court adopts the parties' agreement and hereby construes **"channel estimator for estimating one or both of the amplitude and the phase differential of the received signal to produce as output one or both of an estimated amplitude and an estimated phase differential respectively"** to have its **plain meaning**.

F. "Fourier transform" (Claims 1 and 2), "processor for applying a Fourier transform to the multiplexed information to bring the information into the time domain for transmission" (Claim 1), and "deprocessor for applying an inverse Fourier transform to the samples output from the sampler" (Claim 2)

"Fourier transform" (Claims 1 & 2)	
Plaintiff's Proposed Construction	**Defendants' Proposed Construction**
No construction necessary Alternatively: "a mathematical function for converting between the time domain and frequency domain"	"a mathematical function for converting from the time domain to the frequency domain"
"processor for applying a Fourier transform to the multiplexed information to bring the information into the time domain for transmission" (Claim 1)	
Plaintiff's Proposed Construction	**Defendants' Proposed Construction**
No construction necessary	Indefinite
"deprocessor for applying an inverse Fourier transform to the samples output from the sampler" (Claim 2)	
Plaintiff's Proposed Construction	**Defendants' Proposed Construction**
No construction necessary	Indefinite

(Dkt. No. 197, 12/10/2012 Joint Claim Construction and Prehearing Statement, Ex. A as to '222 Patent, at 4 & 5; *id.*, Ex. B, at 1-2 & 3; Dkt. No. 239, at 18; Dkt. No. 257, at 7.)

(1) The Parties' Positions

Plaintiff argues that the "processor" phrase "plainly calls for a Fourier transform to convert multiplexed information from the frequency domain into the time domain so that it can be transmitted." (Dkt. No. 239, at 16.) Plaintiff argues that Defendants' proposed construction is "directly contrary to the claim language because the claim language points in the opposite direction: from the frequency domain *to the time domain*." (*Id.*, at 17.) Plaintiff further explains that "the phrase 'a Fourier transform' is used generically as a transform that works to transform

information in either direction, from the frequency domain to the time domain, and vice versa." (*Id.*, at 18.)

Defendants respond that "[a] Fourier transform (otherwise known as a fast or forward Fourier transform) is a well known mathematical function that converts data from the time domain to the frequency domain. An inverse Fourier transform (the opposite of a Fourier transform) converts data from the frequency domain to the time domain." (Dkt. No. 257, at 7 (citations omitted).) Defendants cite various extrinsic sources for support but also emphasize that "Claim 2 of the '222 Patent recites 'a deprocessor for applying an *inverse Fourier transform* to the samples output from the sampler." (*Id.*, at 8 (emphasis Defendants').) Defendants argue that "claim 2 demonstrates that the patentees understood the difference between a Fourier transform and an inverse Fourier transform." (*Id.*) Defendants conclude that "[i]f the 'Fourier transform' of claim 1 is interpreted to include an inverse Fourier transform, this would result in a situation where the processor and deprocessor would both be applying an inverse Fourier transform," in which case the deprocessor would be unable to decode the data. (*Id.*, at 8-9.)

Defendants argue that the "processor . . ." term is indefinite because when Defendants' definition of "a Fourier transform" is inserted into Claim 1, "the claim becomes internally inconsistent and nonsensical: 'applying [a mathematical function for converting from the time domain to the frequency domain] to the multiplexed information to bring the information into the time domain for transmission.'" (*Id.*, at 9 (square brackets in original).)

Plaintiffs reply that "forward and inverse Fourier transforms are both 'Fourier transforms'" and that "because Claim 1 specifies that the Fourier transform is converting information 'into the time domain[,] [i]t therefore is abundantly definite as to what specific Fourier transform applie[s]." (Dkt. No. 266, at 5.)

At the March 21, 2013 hearing, Plaintiff noted that although "Fourier transform" has a well-understood plain meaning to persons of ordinary skill in the art, Plaintiff is not opposed to construing the term. Plaintiff re-urged that the term "inverse Fourier transform" in Claim 2 does not specify a particular direction of the transform (that is, from frequency domain to time domain or vice versa) but rather merely specifies that the Fourier transform in Claim 2 is the opposite of, and therefore undoes, the Fourier transform recited in Claim 1. Plaintiff cited the canon that claims should be construed to uphold their validity, and Plaintiff also noted that the constituent term "inverse" is not capitalized in Claim 2, thus indicating a generic meaning rather than the special meaning argued by Defendants. Plaintiff further argued that Claim 2 should not be used to limit the plain, generic language used in Claim 1. *See O.I. Corp. v. Tekmar Co., Inc.*, 115 F.3d 1576, 1582 (Fed. Cir. 1997) ("[T]he doctrine [of claim differentiation] cannot alter a definition that is otherwise clear from the claim language, description, and prosecution history.").

Defendants responded that the Court should apply the clear, plain language of the claims, especially as to Claim 2. *See Wright Med. Tech., Inc. v. Osteonics Corp.*, 122 F.3d 1440, 1445 (Fed. Cir. 1997) ("[W]e must not interpret an independent claim in a way that is inconsistent with a claim which depends from it."); *Chef Am., Inc. v. Lamb-Weston, Inc.*, 358 F.3d 1371, 1375 (Fed. Cir. 2004) ("[W]e have repeatedly declined to rewrite unambiguous patent claim language.").

<u>(2) Analysis</u>

Acer did not address the disputed terms here at issue.

As to "Fourier transform," although Plaintiff proposes that no construction is required, the parties have presented a "fundamental dispute regarding the scope of a claim term," and the Court has a duty to resolve that dispute. *O2 Micro Int'l Ltd. v. Beyond Innovation Tech. Co.*, 521

Case: 14-1437 Document: 30 Page: 115 Filed: 08/29/2014

F.3d 1351, 1362-63 (Fed. Cir. 2008). Further, a construction of this technical term would be helpful to the finder of fact. *See TQP Dev., LLC v. Merrill Lynch & Co., Inc.*, No. 2:08-CV-471, 2012 WL 1940849, at *2 (E.D. Tex. May 29, 2012) (Bryson, J.) ("The Court believes that some construction of the disputed claim language will assist the jury to understand the claims.").

Claims 1 and 2 of the '222 Patent recite (emphasis added):

> 1. A transceiver including a transmitter for transmitting electromagnetic signals and a receiver for receiving electromagnetic signals having amplitude and phase differential characteristics, the transmitter comprising:
> an encoder for encoding information;
> a wideband frequency division multiplexer [f]or multiplexing the information onto wideband frequency channels;
> a low pass filter;
> a local oscillator for upconverting the multiplexed information for transmission;
> *a processor for applying a* [*F*]*ourier transform to the multiplexed information to bring the information into the time domain for transmission;*
> further including, in the receiver of the transceiver[;]
> a bandpass filter for filtering the received electromagnetic signals;
> a local oscillator for downconverting the received electromagnetic signals to produce output;
> a sampler for sampling the output of the local oscillator to produce sampled signals to the channel estimator;
> a channel estimator for estimating one or both of the amplitude and the phase differential of the received signals to produce as output one or both of an estimated amplitude and an estimated phase differential respectively; and
> a decoder for producing signals from the sampled signals and the output from the channel estimator.
>
> 2. The transceiver of claim 1 further including, in the receiver of the transceiver:
> *a deprocessor for applying an inverse Fourier transform to the samples output from the sampler.*

The claims thus recite that "a Fourier transform" is applied by the transmitter and "an inverse Fourier transform" is applied by the receiver. The Background and Summary of the Invention similarly discloses:

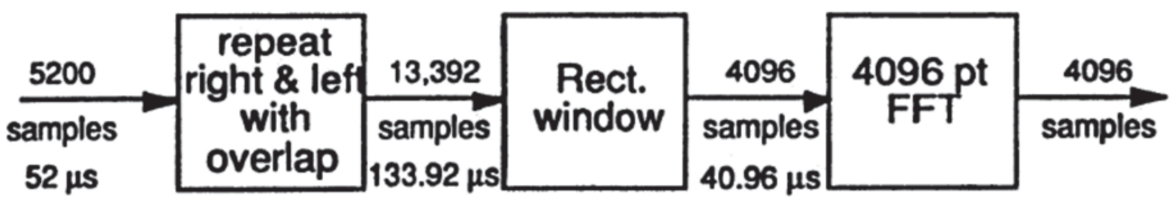
> The apparatus may include a processor for applying a Fourier transform to the multiplexed information to bring the information into the time domain for transmission.

('222 Patent at 3:29-32.)

By contrast, Figures 6a and 6b illustrate that the "processor" at the transmitter can use an "IFFT" (Inverse Fast Fourier Transform) and the "de-proce[]ssor" at the receiver can use an "FFT" (Fast Fourier Transform). (*See id.* at 12:28-31.) Figures 14a and 14b are similar. Figures 6a and 6b are reproduced here:

Procecessor

Fig. 6a



De-procecessor

Fig. 6b

The specification explains, referring to Fig. 6a:

> The *processor* first *inverse Fourier transforms* the 4096 D8PSK modulated symbols output from the modulator. . . . In other words, the processor takes D8PSK symbols in, pulse shapes them and *inverse Fourier transforms* them. On the other hand, *the deprocessor undoes what the processor did*, i.e. it removes the pulse shaping, then *Fourier transforms* the received signal to obtain the original D8PSK symbols.

(*Id.* at 10:24-42.)

In order to harmonize the above-cited claim language, Summary of the Invention, and Figures, the term "Fourier transform" in Claim 1 should be construed generically so as to refer to "converting between the time domain and frequency domain" rather than to converting from the time domain to the frequency domain or vice versa. This interpretation, based on the above-cited intrinsic evidence, is further supported by the opinions of Plaintiff's expert, Dr. Alexander Haimovich. (*See* Dkt. No. 239, Ex. F, 1/10/2013 Haimovich Decl., at pp. 25-26, ¶¶ 77-83; *see also* Dkt. No. 266, Ex. N, 1/31/2013 Haimovich Decl.).[1]

As to the "processor . . ." term in Claim 1, general legal principles regarding indefiniteness are discussed in Section II., above. Although Defendants argue that the claims are "internally inconsistent and nonsensical" (Dkt. No. 257, at 9), the claim language explains the type of conversion that is performed by the Fourier transform. Defendants' indefiniteness argument is therefore hereby expressly rejected as to Claim 1.

Defendants' indefiniteness argument having thus been rejected, no further construction is required as to the "processor" terms. *See U.S. Surgical Corp. v. Ethicon, Inc.*, 103 F.3d 1554, 1568 (Fed. Cir. 1997) ("Claim construction is a matter of resolution of disputed meanings and technical scope, to clarify and when necessary to explain what the patentee covered by the claims, for use in the determination of infringement. It is not an obligatory exercise in redundancy."); *see also O2 Micro*, 521 F.3d at 1362 ("[D]istrict courts are not (and should not be) required to construe every limitation present in a patent's asserted claims."); *cf. Finjan, Inc. v. Secure Computing Corp.*, 626 F.3d 1197, 1207 (Fed. Cir. 2010) ("Unlike *O2 Micro*, where the court failed to resolve the parties' quarrel, the district court rejected Defendants' construction.").

[1] At the March 21, 2013 hearing, the parties also addressed portions of Richard C. Dorf, *The Electrical Engineering Handbook: Circuits, Signals, and Speech and Image Processing* (3d ed. 2006), in particular the section title "Fourier Transforms" and the content of Table 14.2. On balance, this evidence is not sufficiently clear to be of significant weight one way or the other.

As to the "deprocessor . . ." term in Claim 2, however, the recited phrase "inverse Fourier transform" refers to transformation into the time domain, as is evident from the specification, the figures, the extrinsic textbook excerpts provided by Defendants, and the opinions of Plaintiff's own expert. (*See* '222 Patent at 10:24-42 & Figs. 6a, 6b, 14a & 14b; Dkt. No. 257, Ex. C, Clare D. McGillem and George R. Cooper, *Continuous and Discrete Signal and System Analysis* 111, 113 (1991); *id.*, Ex. E, Donald Christiansen, *Electronics Engineers' Handbook* 2.31 (4th ed. 1997); Dkt. No. 239, Ex. F, 1/10/2013 Haimovich Decl., at p. 5, ¶ 15 ("The output of the IFFT, i.e., the transmitted signal, is said to be in the *time domain*.") & p. 25, ¶ 80 ("It is my opinion that one of skill in the art would know that the inverse Fourier transform is typically used to convert from the frequency domain into the time domain . . . ."). The Court hereby expressly rejects Plaintiff's argument that the constituent term "inverse" in Claim 2 refers to the opposite of whatever Fourier transform is applied in Claim 1.

At the March 21, 2013 hearing, Plaintiff agreed that if "inverse Fourier transform" refers to transformation into the time domain (rather than to the opposite of the Fourier transform that is applied in Claim 1), then Claim 2 is invalid as indefinite. The Court agrees with Plaintiff's candid assessment of the effect of the Court's finding in this regard. The Court therefore hereby finds that the "deprocessor . . ." term renders Claim 2 invalid as indefinite.

The Court accordingly hereby construes the disputed terms as set forth in the following chart:

Term	Construction
"Fourier transform" (Claims 1 & 2)	**"a mathematical function for converting between the time domain and frequency domain"**
"processor for applying a Fourier transform to the multiplexed information to bring the information into the time domain for transmission" (Claim 1)	**No construction is necessary apart from the Court's construction of "Fourier transform."**
"deprocessor for applying an inverse Fourier transform to the samples output from the sampler" (Claim 2)	**This term renders Claim 2 invalid as indefinite.**

V. CONSTRUCTION OF DISPUTED TERMS IN THE '802 PATENT

Plaintiff states that the '802 Patent relates to W-OFDM and, in particular, to "Direct Sequence Spread Spectrum (DSSS), which is a communications scheme in which information is spread over code bits of an invertible code." (Dkt. No. 239, at 18 (citing '802 Patent at 1:21-27).) These "code bits" that make up a code are referred to as "chips." Plaintiff explains that multiple codes can be used at the same time to improve throughput, which is a technique that the '802 Patent refers to as "Multi-Code Direct Sequence Spread Spectrum (MC-DSSS)." (*Id.*, at 19.) Plaintiff submits that "[t]he patented W-OFDM system of the '222 patent is included in the '802 patent as one embodiment of an MC-DSSS system." (*Id.*)

The Abstract of the '802 Patent states:

> In this patent, we present MultiCode Direct Sequence Spread Spectrum (MC-DSSS) which is a modulation scheme that assigns up to N DSSS codes to an individual user where N is the number of chips per DSSS code. When viewed as DSSS, MC-DSSS requires up to N correlators (or equivalently up to N Matched Filters) at the receiver with a complexity of the order of N^2 operations. In addition, a non ideal communication channel can cause InterCode Interference (ICI), i.e., interference between the N DSSS codes. In this patent, we introduce new DSSS codes, which we refer to as the "MC" codes. Such codes allow the information in a MC-DSSS signal to be decoded in a sequence of low complexity parallel operations which reduce the ICI. In addition to low complexity decoding

> and reduced ICI[,] MC-DSSS using the MC codes has the following advantages: (1) it does not require the stringent synchronization DSSS requires, (2) it does not require the stringent carrier recovery DSSS requires and (3) it is spectrally efficient.

A. "converter" (Claim 1)

Plaintiff's Proposed Construction	Defendants' Proposed Construction
"a device that accepts data symbols in one form or mode and changes the data symbols to another form or mode"	"a serial-to-parallel device"[2]

(Dkt. No. 197, 12/10/2012 Joint Claim Construction and Prehearing Statement, Ex. A as to '802 Patent, at 1 & 2; Dkt. No. 257, at 16.)

(1) The Parties' Positions

Plaintiff submits that it proposes the construction reached in *Acer*. (Dkt. No. 239, at 19.) Plaintiff argues that:

> [T]he term "converter" is a well-known structural element that has a generally understood structural meaning in the art as confirmed by the dictionary definitions. (*See, e.g.*, Ex. I (MERRIAM-WEBSTER'S COLLEGIATE DICTIONARY (10th ed. 1994) p. 254 ("converter - (d) a device that accepts data in one form and converts it to another")); Ex. J (THE IEEE STANDARD DICTIONARY OF ELECTRICAL AND ELECTRONICS TERMS (6th ed. 1996), p. 222 ("converter - (9) A device capable of converting impulses from one mode to another, such as analog to digital, parallel to serial, or from one code to another.")[)].)

(Dkt. No. 239, at 20.)

Defendants respond that "[t]he only discussion in the specification of the converter is limited: 'a converter 10 converts a stream of data symbols into plural sets of N data symbols each,'" and "converter 10" is identified in Figures 1 and 4 as a serial-to-parallel converter. (Dkt. No. 257, at 16 (quoting '802 Patent at 4:1-2).) Defendants submit that "[t]here is no disclosure

[2] In the December 10, 2012 Joint Claim Construction and Prehearing Statement, Defendants argued that "converter" is a means-plus-function term governed by 35 U.S.C. § 112, ¶ 6. (Dkt. No. 197, Ex. B, at 4.) In their response brief, as well as in the parties' March 7, 2013 P.R. 4-5(d) Joint Claim Construction Chart, Defendants no longer argue that "converter" is a means-plus-function term. (Dkt. No. 257, at 16 n.14; *see* Dkt. No. 285.)

in the '802 Patent of a 'converter' that performs any other type of conversion." (Dkt. No. 257, at 16.) Defendants conclude that Plaintiff's proposal is overbroad and that the extrinsic dictionary definitions cited by Plaintiff are "divorced from the context of the patent." (*Id.*, at 17.)

Plaintiff replies that "the claim language is clear that the converter converts a first stream of data symbols into plural sets of N data symbols each, and there is no basis for Defendants' alleged new concern that the claim could be read to encompass analog to digital converters or a converter for converting from one code to another." (Dkt. No. 266, at 5-6.)

At the March 21, 2013 hearing, Plaintiff further cited disclosures in the specification of analog-to-digital converters and digital-to-analog converters as evidence of the generic meaning of the term "converter" by itself.

(2) Analysis

In *Acer*, "the Court f[ound] that a person of ordinary skill understands that a 'converter' has a generally understood structural meaning that, in general, means a device that accepts data in one form or mode and changes it to another." *Acer* at 40.

Claim 1 of the '802 Patent recites (emphasis added):

> 1. A transceiver for transmitting a first stream of data symbols, the transceiver comprising:
> a *converter* for converting the first stream of data symbols into plural sets of N data symbols each;
> first computing means for operating on the plural sets of N data symbols to produce modulated data symbols corresponding to an invertible randomized spreading of the first stream of data symbols; and
> means to combine the modulated data symbols for transmission.

The specification discloses "a converter 10 converts a stream of data symbols into plural sets of N data symbols each." '802 Patent at 4:1-2. Figures 1 and 4, reproduced in Section V.B., below, illustrate the converter 10 as a "serial-to-parallel" device. On balance, the Court does not limit the generic term "converter" to the specific type of device illustrated in Figures 1 and 4 of

the '802 Patent. *MBO Labs.*, 474 F.3d at 1333 (noting that "patent coverage is not necessarily limited to inventions that look like the ones in the figures"). Having considered the arguments in the present case, the Court reaches the same conclusion here as in *Acer*. *Acer* at 40.

The Court therefore hereby construes **"converter"** to mean **"a device that accepts data symbols in one form or mode and changes the data symbols to another form or mode."**

B. "converting [the / a] first stream of data symbols into plural sets of N data symbols each" (Claims 1 & 23)

Plaintiff's Proposed Construction	Defendants' Proposed Construction
No construction necessary	"taking groups of data symbols from the first data stream, each group having N data symbols, and separating each group into N individual data symbols"

(Dkt. No. 197, 12/10/2012 Joint Claim Construction and Prehearing Statement, Ex. A as to '802 Patent, at 1 & 2; *id.*, Ex. B, at 4.)

(1) The Parties' Positions

Plaintiff argues that "nowhere does it [(the patent)] suggest that the claimed 'converting' requires operation on 'groups of data symbols,' nor is it suggested that converting requires 'separating,' and the Defendant[s'] proposal is improper for at least these reasons." (Dkt. No. 239, at 21.)

Defendants respond:

> The specification confirms that the converter is disclosed by figs. 1 and 4 of the '802 Patent in view of the expression "Sym(k)=[sym(1,k) [. . .] sym(N,k)] is the kth information-bearing vector containing N symbols[.]" Proakis Decl. at ¶ 51 [(Dkt. No. 257-12)]; Ex. B, col. 2:38-40. To one of ordinary skill in the art, this expression describes the algorithm for converting a group of N data symbols Sym(k) into a plural set of data symbols sym(1,k), sym(2,k) . . .sym(N,k), or in other words, into "N individual data symbols."
>
> Given this expression in the context of figs. 1 and 4, one of ordinary skill in the art would understand "converting a/the first stream of data symbols into plural sets of N data symbols each" to mean that at a given point in time (k), the converter is taking a group of data symbols from the stream of data symbols

> Sym(k), each group having N data symbols, and separating each group in parallel into N individual data symbols (sym(1,k), sym(2,k), . . . sym(N,k)). Proakis Decl. at ¶ 52.

(Dkt. No. 257, at 17.)

Plaintiff replies that "Defendants' proposed language does not even appear in the patent specification" and "is simply an improper attempt to narrow the scope of the claim language to a preferred embodiment disclosed in the patent specification." (Dkt. No. 266, at 6.)

At the March 21, 2013 hearing, Defendants submitted that although the "taking" portion of their proposal could perhaps be omitted, the "separating" portion of their proposal is critical.

(2) Analysis

Acer did not address the disputed term here at issue. Although Plaintiff proposes that no construction is required, the parties have presented a "fundamental dispute regarding the scope of a claim term," and the Court has a duty to resolve that dispute. *O2 Micro*, 521 F.3d at 1362-63.

Claims 1 and 23 recite (reissue amendments shown with added text in italics and deleted text in bolded square brackets; underlining added for emphasis):

> 1. A transceiver for transmitting a first stream of data symbols, the transceiver comprising:
> a converter for converting the first stream of data symbols into plural sets of N data symbols each;
> first computing means for operating on the plural sets of N data symbols to produce modulated data symbols corresponding to an invertible randomized spreading of the first stream of data symbols; and
> means to combine the modulated data symbols for transmission.
>
> * * *
>
> 23. A method of exchanging data streams between a plurality of transceivers, the method comprising the steps of:
> converting a first stream of data symbols into plural sets of N data symbols each;
> operating on the plural sets of N data symbols to produce modulated data symbols corresponding to a spreading of the first stream of data symbols over **[**N code symbols**]** *more than one and up to M direct sequence spread spectrum codes*;

combining the modulated data symbols for transmission; and

transmitting the modulated data symbols from a first transceiver at a time when no other of the plurality of transceivers is transmitting.

Figures 1 and 4, cited by Defendants, are reproduced here:

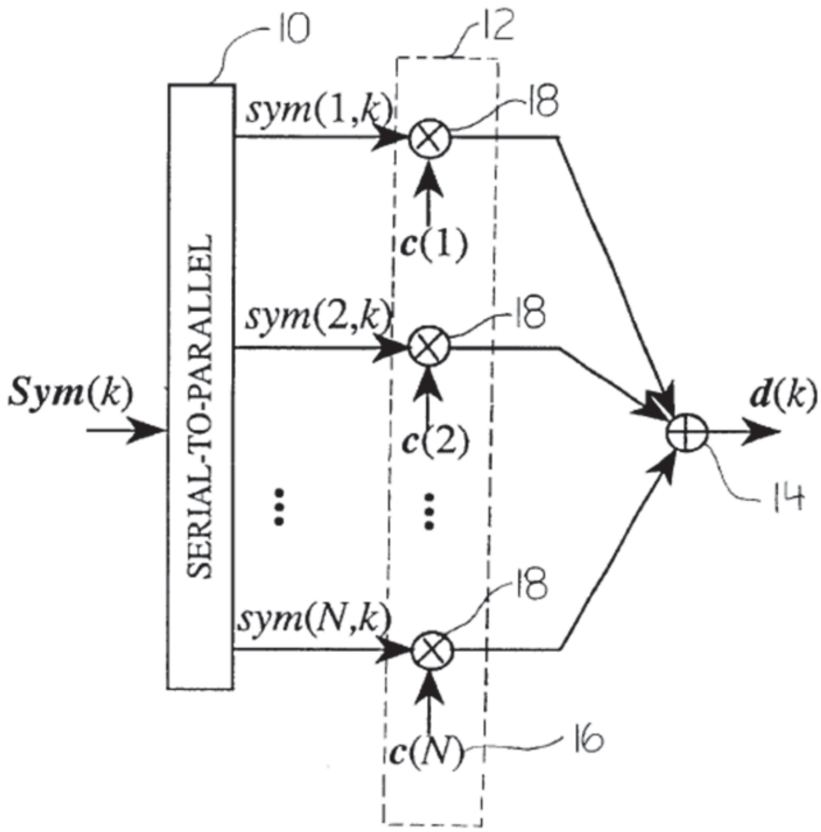


FIGURE 1

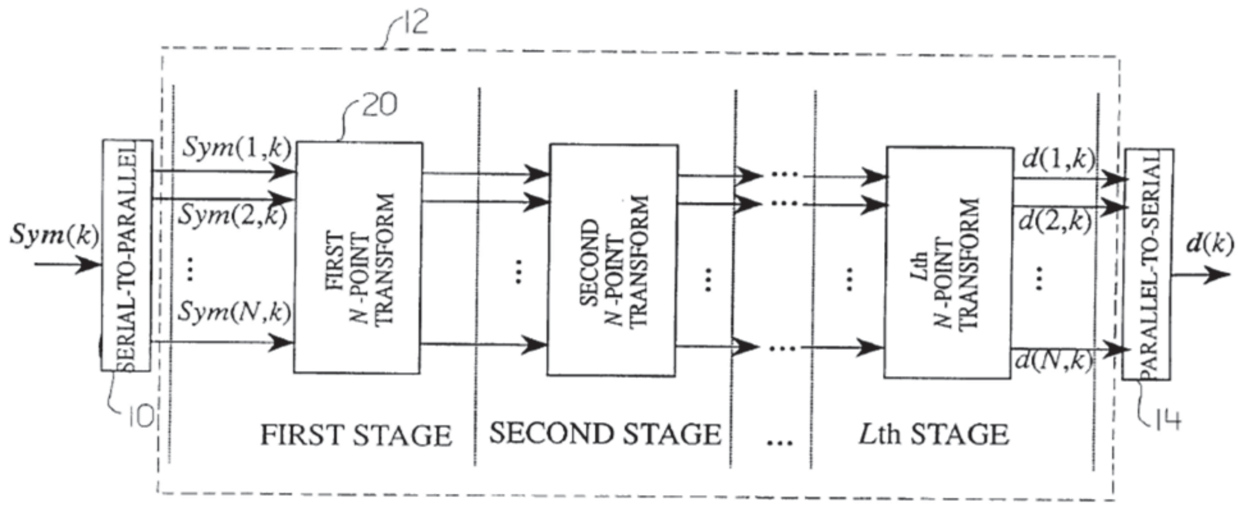


FIGURE 4

On balance, Figures 1 and 4 do not warrant limiting the "converting . . ." term here at issue. *See MBO Labs.*, 474 F.3d at 1333 (noting that "patent coverage is not necessarily limited to inventions that look like the ones in the figures"). The Court therefore rejects Defendants' proposal that each group must be separated into N individual data symbols.

Nonetheless, the disputed term should be construed to clarify and explain that the stream of data symbols is separated into multiple groups and that each group has N data symbols. *See TQP*, 2012 WL 1940849, at *2 ("The Court believes that some construction of the disputed claim language will assist the jury to understand the claims.").

The Court therefore hereby construes **"converting [the / a] first stream of data symbols into plural sets of N data symbols each"** to mean **"separating the first data stream into multiple groups of data symbols such that each group has N data symbols."**

C. "N" (Claims 1, 23 & 25)

Plaintiff's Proposed Construction	Defendants' Proposed Construction
"the number of parallel data symbols"	"the number of chips per DSSS code"

(Dkt. No. 197, 12/10/2012 Joint Claim Construction and Prehearing Statement, Ex. A as to '802 Patent, at 2; *id.*, Ex. B, at 7.)

(1) The Parties' Positions

Plaintiff submits that although *Acer* did not construe "N," "the *Acer* Court's claim construction order recognized that 'N' is 'the number of data symbols,'" as also explained by the patentees during reissue prosecution. (Dkt. No. 239, at 21 (citing *Acer* at 46).) Plaintiff also argues that *Acer* rejected the defendants' argument that "N" must equal "M," where "M" refers to the number of chips per code. (*Id.*, at 23.)

Defendants respond that the Abstract and the Summary of the Invention expressly define "N" as "the number of chips per DSSS code." (Dkt. No. 257, at 18 (citing '802 Patent at Abstract & 2:6-10).) Defendants explain that "the DSSS system spreads a single data symbol using a single DSSS code, and the specification uses the term 'N' to describe the length (i.e., the number of chips) of the DSSS code." (Dkt. No. 257, at 18.) Defendants urge that "the concept of N as the number of chips per DSSS code is critical to the invention of the '802 Patent" because "[t]he patent purports to overcome [the prior art bandwidth] limitation by assigning multiple DSSS codes of length N to each transceiver." (*Id.*, at 19.) Defendants argue that Plaintiff's proposal must be rejected because "there is no definition of N that is given relative to the number of data symbols" and because Plaintiff's proposal simply rephrases surrounding claim language and would render the "N" limitation meaningless. (*Id.*, at 19-20.) Finally, Defendants argue that the declaration filed by the patentees during reissue prosecution does not outweigh the express definition in the specification. (*Id.*, at 20-21.)

Plaintiff replies that "the term 'N' is merely a common way to reference a variable number, which is used as such in different contexts in the specification and claims to refer to

different things." (Dkt. No. 266, at 6.) Plaintiff reiterates that the maximum number of codes need not be assigned to a single transceiver. (*See id.*, at 7-8.)

At the March 21, 2013 hearing, Plaintiff urged that the number of data symbols need not equal the number of DSSS codes because there is no requirement in the claims or the specification that all DSSS codes must be used. For example, if there are ten DSSS codes, nothing precludes the claimed invention from transmitting only six data symbols, Plaintiff argued. In response, Defendants emphasized that the reissue patent added "M" to the claims but did not alter the express definition in the specification that "N" equals the number of chips per DSSS code.

(2) Analysis

As a preliminary matter, the parties agree that the number of available codes is equal to the number of chips per code. Plaintiff explained that this is necessary so that the codes are "orthogonal," that is, so that the codes do not interfere with one another.

Claims 1, 23, and 25 recite (reissue amendments shown with added text in italics and deleted text in bolded square brackets; underlining added for emphasis):

> 1. A transceiver for transmitting a first stream of data symbols, the transceiver comprising:
> a converter for converting the first stream of data symbols into plural sets of N data symbols each;
> first computing means for operating on the plural sets of N data symbols to produce modulated data symbols corresponding to an invertible randomized spreading of the first stream of data symbols; and
> means to combine the modulated data symbols for transmission.
>
> * * *
>
> 23. A method of exchanging data streams between a plurality of transceivers, the method comprising the steps of:
> converting a first stream of data symbols into plural sets of N data symbols each;

operating on the plural sets of N data symbols to produce modulated data symbols corresponding to a spreading of the first stream of data symbols over **[**N code symbols**]** *more than one and up to M direct sequence spread spectrum codes*;

combining the modulated data symbols for transmission; and

transmitting the modulated data symbols from a first transceiver at a time when no other of the plurality of transceivers is transmitting.

* * *

25. The method of claim 23 in which the spreading is an invertible randomized spreading and operating on the plural sets of <u>N</u> data symbols **[**includes**]** *comprises*:

transforming, by application of a transform, each set of <u>N</u> data symbols to generate **[**N**]** modulated data symbols as output.

In *Acer*, the Court found:

While the specification provides an example where M is equal to N, resulting in N data symbols and N codes with N chips per code, the specification never states that the number of data symbols (N) must equal the number of codes or chips per code (M).

Acer at 46.

The specification uses "N" in various contexts:

To enhance the throughput, we allow a single link (i.e., a single transceiver) to use more than one code at the same time. . . . In this patent, we present Multi-Code Direct Sequence Spread Spectrum (MC-DSSS) which is a modulation scheme that assigns *up to N codes* to an individual transceiver where *N is the number of chips per DSSS code*.

('802 Patent at 2:3-10 (emphasis added).)

FIG. 3 is a schematic showing of the ith MC code c(i)=[c(i,1) c(i,2) . . . c(i,NO) where i can take one of the N values: 1,2, . . . N corresponding to the position of the single '1' at the input of the first N-point transform.

(*Id.* at 2:54-57 (unmatched square bracket in original).)

A converter 10 converts a stream of data symbols into *plural sets of N data symbols* each. A computing means 12 operates on the *plural sets of N data symbols* to produce modulated data symbols corresponding to an invertible randomized spreading of the stream of data symbols. A combiner 14 combines the modulated data symbols for transmission. The computing means shown in FIG. 1 includes a source 16 of *N direct sequence spread spectrum code symbols*

> and a modulator 18 to modulate each ith data symbol from each set of *N data symbols* with the I code symbol from the *N code symbol* to generate *N modulated data symbols*, and thereby spread each I data symbol over a separate code symbol.

(*Id.* at 4:1-12 (emphasis added).)

> FIG. 3 illustrates the code generator of the MC codes. Any one of the P N-point transforms in FIG. 3 consists of a reversible transform to the extent of the available arithmetic precision. In other words, with finite precision arithmetic, the transforms are allowed to add a limited amount of irreversible error.
>
> One can use the MC-DSSS transmitter in FIG. 1 and the MC-DSSS receiver in FIG. 2 together with the MC codes generated using the code generator in FIG. 3 in order to implement MC-DSSS using the MC codes.
>
> An alternative transmitter to the one in FIG. 1 using the MC codes in FIG. 3 is shown in FIG. 4.
>
> The alternative transmitter shown in FIG. 4 includes a transformer 20 for *operating on each set of N data symbols to generate N modulated data symbols as output*. A series of transforms are shown.

(*Id.* at 4:29-42 (emphasis added).)

> During reissue prosecution, the patentees declared:
>
> In the claims and detailed description of the original patent, N is the number of data symbols in each data set. In the detailed description and in the summary of the original patent, N is also used in reference to the number of chips per direct sequence spread spectrum code and the maximum number of code[s]. Nevertheless, in the summary of the invention (see column 2, lines 2[-]6), it is clear that there are up to M codes (substituting M for N as stated in the summary), wherein M is the number of chips per code.[] Although M equals N in the detailed description (which is a possible embodiment of the invention), this is not necessary, as indicated at column 2, lines 2-6. M does not have to equal N. M is constrained by the number of chips per code, as illustrated in Figure 3. N, the number of data symbols per set of data symbols, is not constrained. Unfortunately, the lack of clarity from using 'N' in reference to both the number of data symbols and number of codes was erroneously perpetuated in a number of the claims, which this reissue application seeks to correct.

Acer at 45-46 (citing 9/8/1998 Combined Declaration and Power of Attorney for Reissue Patent Application, at 2 (attached to Defendants' response brief as Ex. G)).

"Idiosyncratic language, highly technical terms, or terms coined by the inventor are best understood by reference to the specification." *Intervet Inc. v. Merial Ltd.*, 617 F.3d 1282, 1287 (Fed. Cir. 2010) (citing *Phillips*, 415 F.3d at 1315). "So long as the meaning of an expression is made *reasonably* clear and its use is *consistent* within a patent disclosure, an inventor is permitted to define the terms of his claims." *Intellicall*, 952 F.2d at 1388 (quoting *Lear Siegler, Inc. v. Aeroquip Corp.*, 733 F.2d 881, 889 (Fed. Cir. 1984) (emphasis added)); *Edwards Lifesciences LLC v. Cook Inc.*, 582 F.3d 1322, 1329 (Fed. Cir. 2009) ("[W]e will adopt a definition that is different from the ordinary meaning when 'the patentee acted as his own lexicographer and *clearly* set forth a definition of the disputed claim term in either the specification or prosecution history.'") (quoting *CCS Fitness, Inc. v. Brunswick Corp.*, 288 F.3d 1359, 1366 (Fed. Cir. 2002)) (emphasis added); *Sinogchem Co. v. ITC*, 511 F.3d 1132, 1138 (Fed. Cir. 2007) ("When the specification explains and defines a term used in the claims, *without ambiguity* or incompleteness, there is no need to search further for the meaning of the term.") (citing *Multiform Desiccants, Inc. v. Medzam, Ltd.*, 133 F.3d 1473, 1478 (Fed. Cir. 1998)) (emphasis added); *Vitronics Corp. v. Concenptronic Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996) ("The specification acts as a dictionary when it expressly defines terms used in the claims or when it defines terms by implication.").

On one hand, the specification seems to define "N" by stating that "N is the number of chips per DSSS code." ('802 Patent at 2:6-10 (emphasis added).) On the other hand, the specification uses N to refer to several different concepts, such as "plural sets of N data symbols," "N direct sequence spread spectrum code symbols," and "N modulated data symbols." *Id.* at 4:1-12; *id.* at 4:29-42 ("operating on each set of N data symbols to generate N modulated data symbols as output"). On balance, the specification sets forth no "reasonably clear,"

"consistent" lexicography. *Intellicall*, 952 F.2d at 1388. Instead, in the context in which the term is used in the claims, "N" refers to the number of parallel data symbols.

As for Defendants' argument that "N" must equal "M," "the use of both terms in close proximity in the same claim," namely dependent Claim 2 (which includes all of the limitations of Claim 1), "gives rise to an inference that a different meaning should be assigned to each." *Bancorp Servs., L.L.C. v. Hartford Life Ins. Co.*, 359 F.3d 1367, 1373 (Fed. Cir. 2004). The recital in the claims of different terms, "N" and "M," is plain on its face and is strong evidence that N need not equal M. *See id.*

Defendants have urged that full compensation for the reduction in bandwidth caused by spreading is not achieved unless "N" equals "M," that is, unless the number of data symbols is equal to the number of codes and the number of chips per code. On balance, Defendants have failed to establish that this desired objective must be satisfied by the claims. *See Phillips*, 415 F.3d at 1327 ("[T]he fact that a patent asserts that an invention achieves several objectives does not require that each of the claims be construed as limited to structures that are capable of achieving all of the objectives.") (quoting *Liebel-Flarsheim Co. v. Medrad, Inc.*, 358 F.3d 898, 908 (Fed. Cir. 2004)).

Finally, to whatever extent Defendants maintain that the reissue impermissibly added new matter, claim construction is not the proper vehicle for resolving such a dispute:

> Although claims should be construed in light of the teachings of the specification, and although indefiniteness is a proper subject of claim construction, invalidity for "new matter" should be addressed in the context of summary judgment or trial. *Cf. Brooktree Corp. v. Advanced Micro Devices, Inc.*, 977 F.2d 1555, 1574 (Fed. Cir. 1992) (in context of 35 U.S.C. § 132, noting that "[t]he question whether new matter has been added to an application is a question of fact"); *Hester Indus., Inc. v. Stein, Inc.*, 142 F.3d 1472 (Fed. Cir. 1998) (reviewing grant of summary judgment that asserted reissue claims were invalid for failing to meet requirements of 35 U.S.C. § 251); *Commonwealth Scientific and Indus. Research Org. v. Buffalo Tech., Inc.*, 542 F.3d 1363, 1370, 1378-80 (Fed. Cir. 2008) (with

regard to 35 U.S.C. § 132, reviewing summary judgment regarding new matter, which involves questions of fact).

Advanced Tech. Incubator, Inc. v. Sharp Corp., No. 2:07-CV-468, 2009 WL 4403314, at *20 (E.D. Tex. June 26, 2009); *see Phillips*, 415 F.3d at 1327 ("[W]e have certainly not endorsed a regime in which validity analysis is a regular component of claim construction.").

The Court therefore hereby construes **"N"** to mean **"the number of parallel data symbols."** Defendants' argument that "N" must equal "M" is hereby expressly rejected.

D. "invertible randomized spreading" (Claims 1, 10 & 25)

Plaintiff's Proposed Construction	Defendants' Proposed Construction
"spreading that is reversible and pseudo-randomized"	"spreading that is decodable and pseudo-randomized"

(Dkt. No. 197, 12/10/2012 Joint Claim Construction and Prehearing Statement, Ex. A as to '802 Patent, at 3; *id.*, Ex. B, at 4.)

(1) The Parties' Positions

Plaintiff submits that it proposes the construction reached in *Acer*, and Plaintiff argues that "Defendants' proposed construction attempts to eliminate and eviscerate the 'reversible' aspect of that construction." (Dkt. No. 239, at 24.)

Defendants respond that "'invertible' means that the claimed technology allows a receiver to recover the pre-encoded symbols that are sent from a transmitter." (Dkt. No. 257, at 22.)

Plaintiff replies that "[t]he concept of using 'invertible' or 'reversible' transforms is key to the invention" and that "[t]he use of orthogonal spreading codes allows for the spreading to be properly reversed (or despread) at the receiver." (Dkt. No. 266, at 8-9.) Plaintiff submits that "Defendants' expert testified consistently with this construction." (*Id.*, at 8 n.19 (citing Ex. O, 2/19/2010 Proakis dep., at 24:7-10 ("By invertible, as I understand the term 'invertible' is that

whatever is done at the transmitter can be repeated at the receiver to undo the spreading that was caused at the transmitter.”)).)

(2) Analysis

The parties have agreed that “spreading” means “distributing data symbols over codes to create a wider bandwidth of data symbols.” (Dkt. No. 197, 12/10/2012 Joint Claim Construction and Prehearing Statement, at 2-3.)

In *Acer*, the Court found that “[t]he invertible randomized spreading of a signal is only invertible to the extent of the available arithmetic precision.” *Id.* at 35.

Claims 1, 10, and 25 recite (reissue amendments shown with added text in italics and deleted text in bolded square brackets; underlining added for emphasis):

> 1. A transceiver for transmitting a first stream of data symbols, the transceiver comprising:
>
> a converter for converting the first stream of data symbols into plural sets of N data symbols each;
>
> first computing means for operating on the plural sets of N data symbols to produce modulated data symbols corresponding to an <u>invertible randomized spreading</u> of the first stream of data symbols; and
>
> means to combine the modulated data symbols for transmission.
>
> * * *
>
> 10. The transceiver of claim 1 further **[**including**]** *comprising*:
>
> means for receiving a sequence of modulated data symbols, the modulated data symbols having been generated by <u>invertible randomized spreading</u> of a second stream of data symbols; *and*
>
> second computing means for operating on the sequence of modulated data symbols to produce an estimate of the second stream of data symbols.
>
> * * *
>
> 25. The method of claim 23 in which the spreading is an <u>invertible randomized spreading</u> and operating on the plural sets of N data symbols **[**includes**]** *comprises*:
>
> transforming, by application of a transform, each set of N data symbols to generate **[**N**]** modulated data symbols as output.

Case: 14-1437 Document: 30 Page: 134 Filed: 08/25/2014

The specification discloses decoding as well as reversibility:

> In this patent, we introduce new codes, which we refer to as "MC" codes. Such codes allow the information in a MC-DSSS signal to be *decoded* in a sequence of low complexity parallel operations while reducing the ICI [(InterCode Interference)].

('802 Patent at 2:15-18 (emphasis added); *see id.* at Abstract (similar).)

> FIG. 3 illustrates the code generator of the MC codes. Any one of the P N-point transforms in FIG. 3 consists of a *reversible* transform to the extent of the available arithmetic precision. In other words, with finite precision arithmetic, the transforms are allowed to add a limited amount of irreversible error.

(*Id.* at 4:29-34 (emphasis added).)

> Examples of the N-point transforms in FIG. 3 are a Discrete Fourier Transform (DFT), a Fast Fourier Transform (FFT), a Walsh Transform (WT), a Hilbert Transform (HT), a Randomizer Transform (RT) as the one illustrated in FIG. 8, a Permutator Transform (PT) as the one illustrated in FIG. 9, an Inverse DFT (IDFT), an Inverse FFT (IFFT), an Inverse WT (IWT), an Inverse HT (IHT), an Inverse RT (IRT), an Inverse PT (IPT), and any other *reversible* transform.

(Id. at 4:66-5:7 (emphasis added).)

During prosecution of the '268 Patent (which reissued as the '802 Patent), the patentees clarified the meaning of invertible randomized spreading:

> It is well known in the art that a randomizer transform, as disclosed in the specification at page 4 and in Fig. 8, actually does not generate a perfectly randomized signal, which is impossible, but a near approximation to it, in other words a pseudo-random signal. In fact, it is believed to be well known in the art, and this is the meaning in each of the claims in this application for patent, namely in Claims 19 through 40 and 42 through 46, that when the term "randomizer", "randomized", or "randomizing" is used in relation to a spreading or transform of a signal, then it is a "pseudo-randomizer", "pseudo-randomized", or "pseudo-randomizing" spreading or transform that is being referred to. *The fact that the transform is in each case invertible, means that the transform is known beforehand and a signal encoded by use of the transform can be decoded using the inverse transform.*

(Dkt. No. 257, Ex. I, 2/9/1996 Response to Office Action, at 1-2 (emphasis added).)

In *Acer*, the Court considered these disclosures and this prosecution history and concluded that "[t]he ordinary meaning of the terms 'invert' or 'invertible' means to turn upside

down, to reverse in position or order, to turn or change to the opposite or contrary, or to turn inward or back upon itself. Based upon the specification, the claims, and the prosecution history, one of ordinary skill in the art would find that the term 'invertible' means 'reversible.'" *Acer* at 35-36.

At the March 21, 2013 hearing, Plaintiff urged that the word "orthogonal," in the phrase "orthogonal frequency division multiplexing," means that the codes do not interfere with one another and, as a result, the receiver can obtain "exactly what you started with." Thus, the degree of precision in recovering the original signal depends upon the codes, not merely the spreading or de-spreading processes. Further, as quoted above, the specification discloses that there may be some irreversibility. ('802 Patent at 4:29-34.) The word "reversible," which might be interpreted by the finder of fact as requiring perfect reversibility, should therefore be rejected. The word "decodable," proposed by Defendants, is more appropriate.

The Court accordingly hereby construes **"invertible randomized spreading"** to mean **"spreading that is decodable and pseudo-randomized."**

E. "modulated data symbols" (Claims 1, 10, 12, 14, 15, 23, 25, 29 & 31)

Plaintiff's Proposed Construction	Defendants' Proposed Construction
"data symbols that have been spread by a spreading code"	"spread and pseudo-randomized symbols"

(Dkt. No. 197, 12/10/2012 Joint Claim Construction and Prehearing Statement, Ex. A as to '802 Patent, at 3; *id.*, Ex. B, at 5.)

(1) The Parties' Positions

Plaintiff argues that "[n]othing in the specification, claims, or the claim construction order suggests that 'modulated data symbols' must be 'pseudorandomized,' as would be required by Defendants' proposed construction." (Dkt. No. 239, at 26.)

Defendants respond that during prosecution, the patentees relied on randomization of the symbols. (Dkt. No. 257, at 23.)

Plaintiff replies that "Defendants' argument and proposed construction are directly contradicted by claims 23 and 25 of the patent" because whereas Claim 25 recites "invertible randomized spreading," Claim 23, from which Claim 25 depends, only recites "spreading." (Dkt. No. 266, at 9.)

<u>(2) Analysis</u>

Acer construed "modulator" as "a device that varies one or more of the amplitude, frequency, or phase of each data symbol." *Acer* at 57.

As a threshold matter, Plaintiff's claim differentiation argument as to Claim 25 is of limited weight because Claim 25 recites other limitations, such as that the spreading is invertible and that a transform is applied. *Rembrandt Techs., LP v. Cablevision Sys. Corp.*, No. 2012-1022, 2012 WL 4017470, at *9 (Fed. Cir. Sept. 13, 2012) ("There is no reason to apply the doctrine of claim differentiation, however, where, as here, the district court's construction does not render any claim redundant or superfluous."); *see Marine Polymer Techs., Inc. v. HemCon, Inc.*, 672 F.3d 1350, 1359 (Fed. Cir. 2012) ("[C]laim differentiation is not a hard and fast rule and will be overcome by a contrary construction dictated by the written description or prosecution history") (internal quotation marks omitted); *cf. Wenger Mfg., Inc. v. Coating Mach. Sys., Inc.*, 239 F.3d 1225, 1233 (Fed. Cir. 2001) ("Claim differentiation, while often argued to be controlling when it does not apply, is clearly applicable when there is a dispute over whether a limitation found in a dependent claim should be read into an independent claim, *and that limitation is the only meaningful difference between the two claims*.") (emphasis added).

The specification discloses:

> *A computing means 12 operates on the plural sets of N data symbols to produce modulated data symbols corresponding to an invertible randomized spreading of the stream of data symbols.* A combiner 14 combines the *modulated data symbols* for transmission. The computing means shown in FIG. 1 includes a source 16 of N direct sequence spread spectrum code symbols and a modulator 18 to modulate each ith data symbol from each set of N data symbols with the I code symbol from the N code symbol to generate N *modulated data symbols*, and thereby spread each I data symbol over a separate code symbol.

(*Id.* at 4:2-12 (emphasis added).)

> The alternative transmitter shown in FIG. 4 includes a transformer 20 for operating on each set of N data symbols to generate N *modulated data symbols* as output. A series of transforms are shown.

(*Id.* at 4:40-42 (emphasis added).)

During prosecution of the '268 Patent (from which the '802 Patent reissued), the patentees explained:

> . . . Burckert et al. ('614) and Albrieux et al. ('952) are considered the main references for the claims as amended. A sufficiently distinguishing feature of the independent Claims 19 and 35,[3] and all of the claims dependent on those claims, is that the apparatus of the invention operates on the symbols to be transmitted to generate an *invertible randomized spreading* of the symbols. The same argument applies to the method claims 42 through 46.
>
> *The key here is the randomization of the transformation.* It is known in the art to spread symbols and spread spectrum applications, including by using Walsh codes as shown in Albrieux et al. ('952). However, depending upon the data, the effect might be to de-spread the symbols, generating an unwanted pulse. *With randomized spreading, it is less likely that a pulse will be generated.* Hence, in general, the operation of the invention tends to reduce the peak to average intensity ratio of the spread signal being transmitted.

(Dkt. No. 257, Ex. H, 8/23/1995 Response to Office Action, at 15-16 (emphasis added).)

On balance, neither the specification nor the prosecution history contain any definitive statement or disclaimer mandating that "modulated data symbols" must be pseudo-randomized. *Omega Eng. v. Raytek Corp.*, 334 F.3d 1314, 1324 (Fed. Cir. 2003) ("As a basic principle of

---

[3] Application claims 19 and 35 appear to have issued as Claims 1 and 17 of the '268 Patent and, in turn, the '802 Patent.

claim interpretation, prosecution disclaimer promotes the public notice function of the intrinsic evidence and protects the public's reliance on *definitive* statements made during prosecution.") (emphasis added). Instead, randomization is a desirable feature that is addressed by other claim language, such as the term "invertible randomized spreading," which appears in Claim 1 and is discussed in Section V.D., above. Randomization therefore should not be imported into the term "modulated data symbols." *Electro Med.*, 34 F.3d at 1054.

The Court therefore hereby construes **"modulated data symbols"** to mean **"data symbols that have been spread by a spreading code."**

F. "means for receiving a sequence of modulated data symbols, the modulated data symbols having been generated by invertible randomized spreading of a second stream of data symbols" (Claim 10)

Plaintiff's Proposed Construction	Defendants' Proposed Construction
Function: "receiving a sequence of modulated data symbols, the modulated data symbols having been generated by invertible randomized spreading of a second stream of data symbols" Corresponding Structure: "element 22 of Figures 2 and 5, column 4:18-21, and equivalents thereof"	Indefinite Function: "receiving a sequence of modulated symbols, the modulated data symbols having been generated by invertible randomized spreading of a second stream of data symbols" Corresponding Structure: No structure disclosed

(Dkt. No. 197, 12/10/2012 Joint Claim Construction and Prehearing Statement, Ex. A as to '802 Patent, at 4; *id.*, Ex. B, at 5-6.)

(1) The Parties' Positions

Plaintiff submits that it proposes the construction reached in *Acer*, and Plaintiff argues that *Acer* explicitly rejected an argument that the specification fails to disclose corresponding structure. (Dkt. No. 239, at 26-27.) Plaintiff has also emphasized that in the *Acer* proceedings,

Defendants Apple, Dell, and HP agreed that "item 22" of Figure 2 was corresponding structure. (*Id.*, at 27 (citing *Acer* at 49).)

Defendants respond: "The only mention in the specification of the means for receiving is limited to: 'A sequence of modulated data symbols is received at 22.' ['802 Patent], col. 4:18 . . . . This description does not define any structure but, rather, describes the function of something numbered 22." (Dkt. No. 257, at 24.) Defendants note that the number "22" in Figure 2 points to a horizontal line without any explanation, and "[o]ne of ordinary skill in the art would not understand what, if any, structure (e.g., physical structure, computer code, algorithm) is associated with the line in Figure 2 and unidentified number 22." (*Id.*, at 25.)

In reply, Plaintiff reiterates that *Acer* cited element 22 of Figure 2 and rejected an indefiniteness argument as to the disputed term. (Dkt. No. 266, at 10.)

At the March 21, 2013 hearing, Plaintiff withdrew any estoppel argument based on Defendants Apple, Dell, and HP having not argued for a finding of indefiniteness during the *Acer* case. Plaintiff also argued for the first time that the corresponding structure includes structure that separates the data stream, as shown by one arrow leading to multiple arrows in Figure 2 and by the "Serial-to-Parallel" block in Figure 5. Defendants responded that Plaintiff's interpretation of Figures 2 and 5 is not described in the specification.

(2) Analysis

General legal principles regarding indefiniteness are discussed in Section II., above.

Title 35 U.S.C. § 112 ¶ 6, allows a patentee to express a claim limitation as "a means or step for performing a specified function without the recital of structure, material, or acts in support thereof." *See Inventio AG v. Thyssenkrupp Elevator Ams.*, 649 F.3d 1350, 1355-56 (Fed. Cir. 2011). The Federal Circuit has further clarified what such functional claiming requires:

> Thus, in return for generic claiming ability, the applicant must indicate in the specification what structure constitutes the means. If the specification is not clear as to the structure that the patentee intends to correspond to the claimed function, then the patentee has not paid the price but is rather attempting to claim in functional terms unbounded by any reference to structure in the specification. Thus, if an applicant fails to set forth an adequate disclosure, the applicant has in effect failed to particularly point out and distinctly claim the invention as required by the second paragraph of § 112.

Biomedino, LLC v. Waters Techs. Corp., 490 F.3d 946, 948 (Fed. Cir. 2007) (citations and internal quotation marks omitted).

"If there is no structure in the specification corresponding to the means-plus-function limitation in the claims, the claim will be found invalid as indefinite." *Id.* at 950; *accord Ergo Licensing, LLC v. CareFusion 303, Inc.*, 673 F.3d 1361, 1363-65 (Fed. Cir. 2012); *Tech. Licensing Corp. v. Videotek, Inc.*, 545 F.3d 1316, 1338 (Fed. Cir. 2008). Further, "the written description must clearly link or associate structure to the claimed function." *Telcordia Techs., Inc. v. Cisco Sys., Inc.*, 612 F.3d 1365, 1376 (Fed. Cir. 2010).

In *Acer*, "[t]he Court f[ound] that the specification sufficiently links element 22 of Figures 2 and 5 as the corresponding structure for the 'means for receiving' limitation, and [the Court] therefore reject[ed the d]efendants' arguments to the contrary." *Acer* at 51.

Figures 2 and 5 are reproduced here:

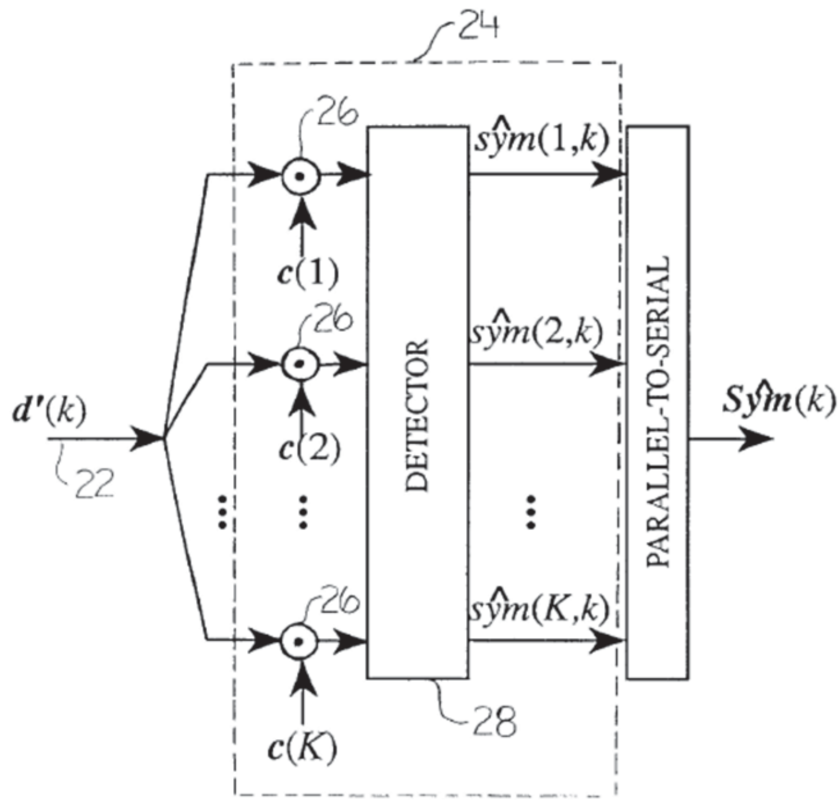


FIGURE 2

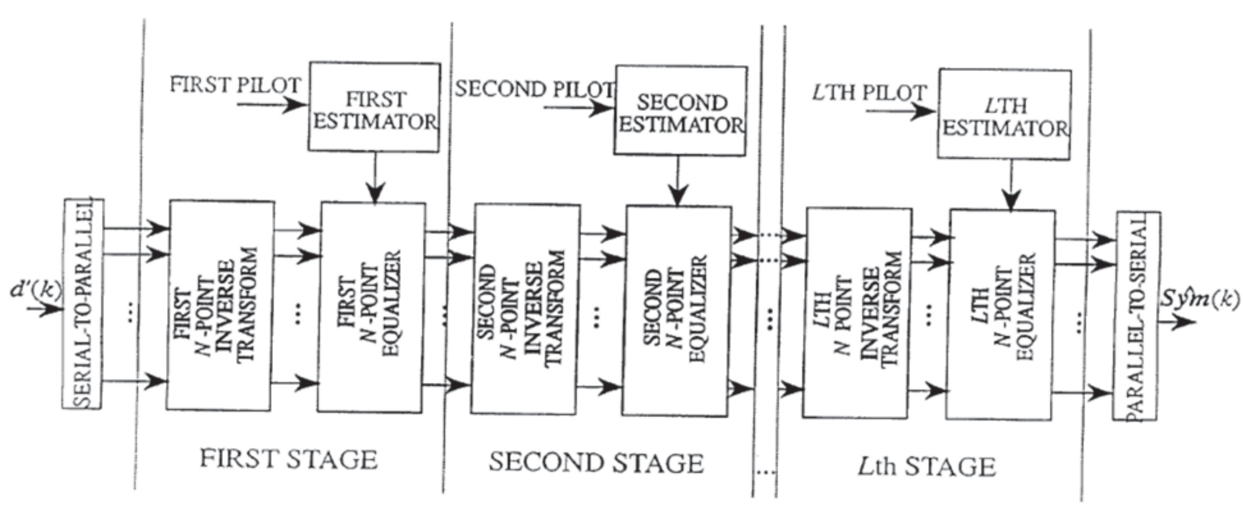


FIGURE 5

Case: 14-1437 Document: 30 Page: 142 Filed: 08/25/2014

The specification discloses:

> A sequence of modulated data symbols is received at 22 in which the sequence of modulated data symbols has been generated by the transmitter such as is shown in FIG. 1 or 4.

(‘802 Patent at 4:18-21.) This disclosure adequately “link[s] or associate[s] structure to the claimed function.” *Telcordia*, 612 F.3d at 1376.

Upon consideration of the arguments here, the Court reaches substantially the same conclusion as in *Acer*. The Court finds that adequate corresponding structure is disclosed in Figure 2 and the corresponding written description. Because Figure 5 does not include the reference numeral 22, the Court’s construction will refer only to Figure 2.

The Court therefore hereby finds that for the term **“means for receiving a sequence of modulated data symbols, the modulated data symbols having been generated by invertible randomized spreading of a second stream of data symbols,”** the function is **“receiving a sequence of modulated data symbols, the modulated data symbols having been generated by invertible randomized spreading of a second stream of data symbols”** and the corresponding structure is **“element 22 of Figure 2, and equivalents thereof.”**

G. “a set of more than one and up to M codes, where M is the number of chips per code” (Claims 12 & 23) and “more than one and up to M direct sequence spread spectrum codes” (Claim 23)

“a set of more than one and up to M codes, where M is the number of chips per code” (Claims 12 & 23)	
Plaintiff’s Proposed Construction	**Defendants’ Proposed Construction**
No construction necessary	Indefinite
“more than one and up to M direct sequence spread spectrum codes” (Claim 23)	
Plaintiff’s Proposed Construction	**Defendants’ Proposed Construction**
No construction necessary	Indefinite

Case: 14-1437 Document: 30 Page: 143 Filed: 08/29/2014

(Dkt. No. 197, 12/10/2012 Joint Claim Construction and Prehearing Statement, Ex. A as to '802 Patent, at 5; *id.*, Ex. B, at 6-7.)

At the March 21, 2013 hearing, Defendants withdrew their indefiniteness argument and agreed that the disputed terms should be construed to have their plain meaning. Defendants' explained that their validity challenge would be more appropriately brought by later motion rather than as part of claim construction proceedings. Plaintiff had no objection to the Court construing the disputed terms to have their plain meaning.

The Court therefore adopts the parties' agreement and hereby construes **"a set of more than one and up to M codes, where M is the number of chips per code"** and **"more than one and up to M direct sequence spread spectrum codes"** to have their **plain meaning**.

H. "means to apply diversity to the combined modulated data symbols before transmission" (Claim 15)

Plaintiff's Proposed Construction	Defendants' Proposed Construction
Function: "apply diversity to the combined modulated data symbols before transmission" Corresponding Structure: "element 32 in FIG. 6, columns 4:47-51, 5:26-30, 6:36-38, and equivalents thereof"	Indefinite Function: "apply diversity to the combined modulated data symbols" Corresponding Structure: No structure disclosed

(Dkt. No. 197, 12/10/2012 Joint Claim Construction and Prehearing Statement, Ex. A as to '802 Patent, at 6; *id.*, Ex. B, at 7.)

<u>(1) The Parties' Positions</u>

Plaintiff argues that although Defendants urge that the disputed term is indefinite because of lack of corresponding structure, "[t]he '802 patent provides several descriptions of the 'means

to apply diversity.'" (Dkt. No. 239, at 28 (citing '802 Patent at 4:47-51, 5:26-30, 6:36-38 & Fig. 6).)

Defendants respond that disclosure of "diversity module 32" is insufficient to constitute corresponding structure. (Dkt. No. 257, at 25.) Defendants also argue that the references to "time diversity" and "antenna diversity," cited by Plaintiff, "describe types of functions" and do not constitute structure. (*Id.*, at 26.) Defendants conclude that the disputed means-plus-function term lacks corresponding structure and thereby renders the claim invalid as indefinite. (*Id.*)

Plaintiff replies that "'time diversity' and 'antenna diversity' were structures well-known to persons of ordinary skill for applying diversity to modulated data symbols." (Dkt. No. 266, at 10.)

(2) Analysis

"If there is no structure in the specification corresponding to the means-plus-function limitation in the claims, the claim will be found invalid as indefinite." *Biomedino*, 490 F.3d at 950; *accord Ergo Licensing*, 673 F.3d at 1363-65; *Tech. Licensing*, 545 F.3d at 1338. Further, "the written description must clearly link or associate structure to the claimed function." *Telcordia*, 612 F.3d at 1376.

The portions of the specification cited by Plaintiff disclose:

> Both transmitters in FIGS. 1 and 4 allow using shaper 30 in *diversity module 32* [for] shaping and time diversity of the MC-DSSS signal as shown in FIG. 6. We will refer to the MC-DSSS frame with shaping and time diversity as a Data frame.
>
> Both receivers in FIGS. 2 and 5 allow diversity combining followed by the unshaping of the Data frame as shown in FIG. 7. A Synch. is required in FIG. 7 for frame synchronization.

('802 Patent at 4:47-55 (emphasis added).)

> *Time Diversity in FIG. 6* can consist of repeating the MC-DSSS frame several times. It can also consist of repeating the frame several times then complex

> conjugating some of the replicas, or shifting some of the replicas in the frequency domain in a cyclic manner.
>
> Diversity combining in FIG. 7 can consist of cophasing, selective combining, Maximal Ratio combining or equal gain combining.

(*Id.* at 5:26-33 (emphasis added).)

> A further extension to the MC-DSSS modulation technique consists of using *antenna Diversity* in order to improve the Signal-to-Ratio level at the receiver.

(*Id.* at 6:36-38 (emphasis added).) The concepts of "time diversity" and "antenna diversity" are explained further in portions of textbooks that Plaintiff cited and attached to its reply brief. (Dkt. No. 266, Ex. P, Roger L. Peterson, Rodger E. Ziemer, and David E. Borth, *Introduction to Spread Spectrum Communications* 497-500 (1995); *id.*, Ex. Q, John G. Proakis, *Digital Communications* 719-20 (2d ed. 1989).)

Figure 6 of the '802 Patent is reproduced here:

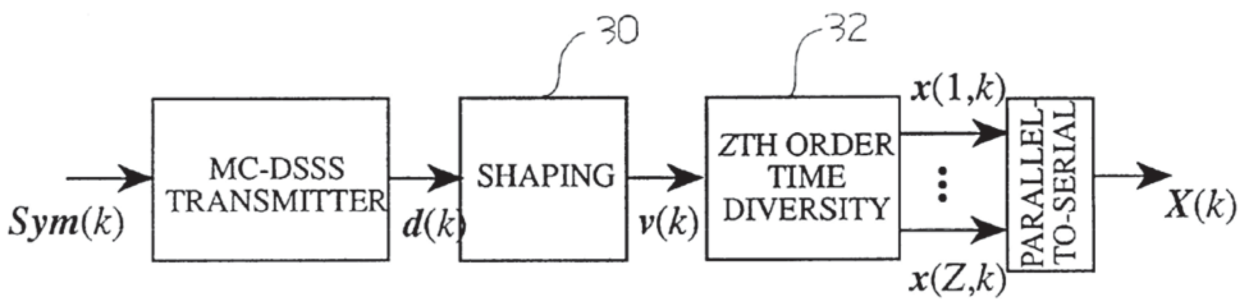


FIGURE 6

Under some circumstances, the disclosure of an element in the specification might not satisfy the requirement for disclosure of corresponding structure. *See Alcatel USA Res. Inc. v. Microsoft Corp.*, No. 6:06-CV-500, 2008 WL 2625852, at *17 (E.D. Tex. June 27, 2008) (Davis, J.) (finding that the "broad disclosure of a 'set-up program module' executed on a processor, similar to 'software' or 'appropriate programming,' is not sufficient algorithmic

structure"); *see also Ranpack Corp. v. Storopack, Inc.*, No. 98-1009, 1998 WL 513598, at *2 (Fed. Cir. July 15, 1998) (finding that a "module" was a "black box" that did not connote sufficient structure); *Mass. Inst. of Tech. v. Abacus Software*, 462 F.3d 1344, 1354 (Fed. Cir. 2006) ("The generic terms 'mechanism,' 'means,' 'element,' and 'device,' typically do not connote sufficiently definite structure.").

On balance, the disclosure of the "Zth Order Time Diversity" element 32 in Figure 6, as well as the accompanying description in the specification, "clearly link or associate structure to the claimed function." *Telcordia*, 612 F.3d at 1376. Defendants' indefiniteness challenge is therefore hereby expressly rejected.

The Court accordingly hereby finds that for the term **"means to apply diversity to the combined modulated data symbols before transmission,"** the function is **"apply diversity to the combined modulated data symbols before transmission"** and the corresponding structure is **"element 32 in FIG. 6, and equivalents thereof."**

I. "first computing means for operating on the plural sets of N data symbols to produce modulated data symbols corresponding to an invertible randomized spreading of the first stream of data symbols" (Claim 1), "means to combine the modulated data symbols for transmission" (Claim 1), and "second computing means for operating on the sequence of modulated data symbols to produce an estimate of the second stream of data symbols" (Claim 10)

"first computing means for operating on the plural sets of N data symbols to produce modulated data symbols corresponding to an invertible randomized spreading of the first stream of data symbols" (Claim 1)	
Plaintiff's Proposed Construction	**Defendants' Proposed Construction**
Function: "operating on the plural sets of N data symbols to produce modulated data symbols corresponding to an invertible randomized spreading of the first stream of data symbols" Corresponding Structure: "element 12 of Figures 1 and 4, columns 2:6-10, 2:36-40, 2:58-62, 4:2-12 and 4:35-44, and equivalents thereof"	Function: "operating on the plural sets of N data symbols to produce modulated data symbols corresponding to an invertible randomized spreading of the first stream of data symbols" Corresponding Structure: "element 12 as shown in Figs. 1 and 4 and described in col. 2:6-10, 36-40, 58-62; col. 4:2-4, 6-12, 35-44"

"means to combine the modulated data symbols for transmission" (Claim 1)	
Plaintiff's Proposed Construction	**Defendants' Proposed Construction**
Function: "combine the modulated data symbols for transmission" Corresponding Structure: "element 14 of Figures 1 and 4, column 4:5-7, and equivalents thereof"	Function: "combine the modulated data symbols for transmission" Corresponding Structure: "combiner 14 as shown in Fig. 1 and described in col. 4:4-6 or parallel-to-serial converter 14 as shown in Fig. 4"

"second computing means for operating on the sequence of modulated data symbols to produce an estimate of the second stream of data symbols" (Claim 10)	
Plaintiff's Proposed Construction	**Defendants' Proposed Construction**
Function: "operating on the sequence of modulated data symbols to produce an estimate of the second stream of data symbols" Corresponding Structure: "element 24 of Figure 2, the elements of FIG. 5 between the serial-to-parallel and parallel-to-serial converters, columns 2:41-54, 2:63-67, 4:21-28, and equivalents thereof"	Function: "operating on the sequence of modulated data symbols to produce an estimate of the second stream of data symbols" Corresponding Structure: "element 24 as shown in Fig. 2 and described in col. 2:41-53; col. 4:21-28 or the component between the serial-to-parallel and parallel-to-serial converters as shown in Fig. 5 and described in col. 2:63-67"

(Dkt. No. 197, 12/10/2012 Joint Claim Construction and Prehearing Statement, Ex. A as to '802 Patent, at 3 & 4-5; *id.*, Ex. B, at 4, 5 & 6.)

After the close of briefing, the parties reached agreement, as reflected in the parties' March 7, 2013 P.R. 4-5(d) Joint Claim Construction Chart (*see* Dkt. No. 285), that the disputed terms should be construed as follows:

Case: 14-1437 Document: 30 Page: 149 Filed: 08/29/2014

Term	Construction
"first computing means for operating on the plural sets of N data symbols to produce modulated data symbols corresponding to an invertible randomized spreading of the first stream of data symbols" (Claim 1)	**Function:** **"operating on the plural sets of N data symbols to produce modulated data symbols corresponding to an invertible randomized spreading of the first stream of data symbols"** **Corresponding Structure:** **"element 12 of Figures 1 and 4, columns 2:6-10, 2:36-40, 2:58-62, 4:2-12 and 4:35-44, and equivalents thereof"**
"means to combine the modulated data symbols for transmission" (Claim 1)	**Function:** **"combine the modulated data symbols for transmission"** **Corresponding Structure:** **"element 14 of Figures 1 and 4, column 4:5-7, and equivalents thereof"**
"second computing means for operating on the sequence of modulated data symbols to produce an estimate of the second stream of data symbols" (Claim 10)	**Function:** **"operating on the sequence of modulated data symbols to produce an estimate of the second stream of data symbols"** **Corresponding Structure:** **"element 24 of Figure 2, the elements of FIG. 5 between the serial-to-parallel and parallel-to-serial converters, columns 2:41-54, 2:63-67, 4:21-28, and equivalents thereof"**

The Court hereby adopts the parties' agreed constructions.

VI. CONCLUSION

The Court adopts the constructions set forth in this opinion for the disputed terms of the patents-in-suit. The parties are ordered that they may not refer, directly or indirectly, to each other's claim construction positions in the presence of the jury. Likewise, the parties are ordered to refrain from mentioning any portion of this opinion, other than the actual definitions adopted

by the Court, in the presence of the jury. Any reference to claim construction proceedings is limited to informing the jury of the definitions adopted by the Court.

Within thirty (30) days of the issuance of this Memorandum Opinion and Order, the parties are hereby ORDERED, in good faith, to mediate this case with the mediator agreed upon by the parties. As a part of such mediation, each party shall appear by counsel and by at least one corporate officer possessing sufficient authority and control to unilaterally make binding decisions for the corporation adequate to address any good faith offer or counteroffer of settlement that might arise during such mediation. Failure to do so shall be deemed by the Court as a failure to mediate in good faith and may subject that party to such sanctions as the Court deems appropriate.

So ORDERED and SIGNED this 11th day of April, 2013.

Rodney Gilstrap

RODNEY GILSTRAP
UNITED STATES DISTRICT JUDGE

US00RE37802E

(19) **United States**
(12) **Reissued Patent**
Fattouche et al.
(10) **Patent Number: US RE37,802 E**
(45) **Date of Reissued Patent: Jul. 23, 2002**

(54) **MULTICODE DIRECT SEQUENCE SPREAD SPECTRUM**

(75) Inventors: **Michel T. Fattouche**; **Hatim Zaghloul**, both of Calgary (CA)

(73) Assignee: **Wi-LAN Inc.**, Calgary (CA)

(21) Appl. No.: **09/151,604**

(22) Filed: **Sep. 10, 1998**

Related U.S. Patent Documents

Reissue of:
(64) Patent No.: **5,555,268**
Issued: **Sep. 10, 1996**
Appl. No.: **08/186,784**
Filed: **Jan. 24, 1994**

(51) **Int. Cl.**[7] **H04B 1/707**; H04B 1/69

(52) **U.S. Cl.** **375/141**; 370/209; 375/146; 375/147; 380/34

(58) **Field of Search** 375/200, 201, 375/202, 203, 204, 206, 207, 208, 209, 210, 130–153, 271, 279, 280, 322, 329, 332; 380/34, 46; 370/203, 204, 205, 206, 207, 208, 209, 210, 211; 364/717.01, 717.02, 717.03, 717.04, 717.05, 717.06, 717.07; 331/78; 714/746, 752, 778, 781, 782

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,485,949	A	12/1969	De Haas
3,789,149	A	1/1974	Clark
3,956,619	A	5/1976	Mundy et al.
3,987,374	A	10/1976	Jones, Jr.
4,092,491	A	5/1978	Frazer
4,164,628	A	8/1979	Ward et al.
4,306,308	A	12/1981	Nossen
4,457,004	A	6/1984	Gersho et al.
4,520,490	A	5/1985	Wei
4,601,005	A	7/1986	Kilvington
4,601,045	A	7/1986	Lubarsky
4,615,040	A	9/1986	Mojoli et al.
4,623,980	A	11/1986	Vary

(List continued on next page.)

FOREIGN PATENT DOCUMENTS

CA	1 203 576	8/1977
EP	0 562 868 A2	9/1993
EP	0 567 771 A2	11/1993
GB	2 146 875 A	4/1985

OTHER PUBLICATIONS

Jinkang Zhu, Hongbin Zhang, Yucong Gu, Principle and Performance of Variable Rate Multi–code CDMA Method, 1995 Fourth IEEE International Conference on Universal Personal Communications. Record. Gateway to the 21st Century (Cat. No. 95TH8128). IEEE, pp. 256–259, New York, NY, USA, 1995.

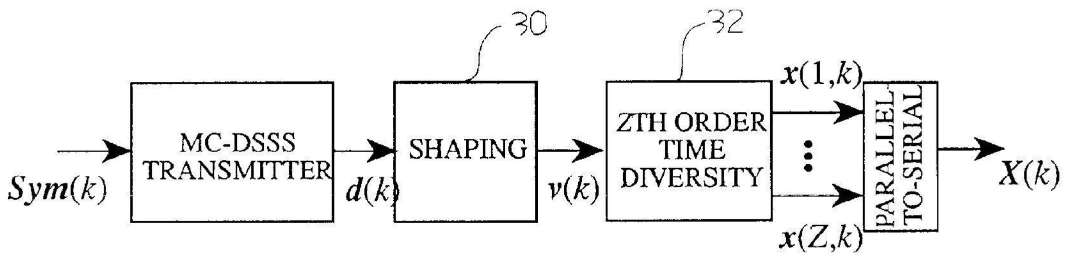
(List continued on next page.)

Primary Examiner—Bernarr E. Gregory
(74) *Attorney, Agent, or Firm*—Christensen O'Connor Johnson Kindness PLLC

(57) **ABSTRACT**

In this patent, we present MultiCode Direct Sequence Spread Spectrum (MC-DSSS) which is a modulation scheme that assigns up to N DSSS codes to an individual user where N is the number of chips per DSSS code. When viewed as DSSS, MC-DSSS requires up to N correlators (or equivalently up to N Matched Filters) at the receiver with a complexity of the order of N^2 operations. In addition, a non ideal communication channel can cause InterCode Interference (ICI), i.e., interference between the N DSSS codes. In this patent, we introduce new DSSS codes, which we refer to as the "MC" codes. Such codes allow the information in a MC-DSSS signal to be decoded in a sequence of low complexity parallel operations which reduce the ICI. In addition to low complexity decoding and reduced ICI. MC-DSSS using the MC codes has the following advantages: (1) it does not require the stringent synchronization DSSS requires, (2) it does not require the stringent carrier recovery DSSS requires and (3) it is spectrally efficient.

40 Claims, 20 Drawing Sheets



PX-0002
Wi-LAN v. HTC Corp. et. al.
Civil Action No. 2:11-cv-068-JRG

U.S. PATENT DOCUMENTS

4,641,318 A		2/1987	Addeo	
4,660,215 A		4/1987	Horiike et al.	
4,694,466 A		9/1987	Kadin	
4,713,817 A		12/1987	Wei	
4,731,816 A		3/1988	Hughes-Hartogs	
4,799,214 A		1/1989	Kaku	
4,809,299 A		2/1989	Ho	
4,829,540 A		5/1989	Waggener, Sr. et al.	
4,868,874 A		9/1989	Takatori et al.	
4,881,241 A		11/1989	Pommier et al.	
4,893,266 A		1/1990	Deem	
4,901,307 A		2/1990	Gilhousen et al.	
4,914,699 A		4/1990	Dunn et al.	
4,928,310 A	*	5/1990	Goutzoulis et al.	380/46
4,933,952 A	*	6/1990	Albrieux et al.	375/200
4,944,009 A	*	7/1990	Micali et al.	380/46
4,979,183 A		12/1990	Cowart	
5,029,180 A		7/1991	Cowart	
5,034,911 A		7/1991	Rachels	
5,063,560 A		11/1991	Yerbury et al.	
5,063,574 A		11/1991	Moose	
5,073,899 A		12/1991	Collier et al.	
5,089,982 A		2/1992	Gran et al.	
5,103,459 A		4/1992	Gilhousen et al.	
5,128,964 A		7/1992	Mallory	
5,134,464 A		7/1992	Basile et al.	
5,151,919 A		9/1992	Dent	
5,157,686 A		10/1992	Omura et al.	
5,166,924 A		11/1992	Moose	
5,166,951 A		11/1992	Schilling	
5,193,094 A		3/1993	Viterbi	
5,210,770 A		5/1993	Rice	
5,228,025 A		7/1993	Le Floch et al.	
5,235,614 A	*	8/1993	Bruckert et al.	370/209
5,268,926 A		12/1993	Sebilet	
5,274,629 A		12/1993	Helard et al.	
5,278,844 A	*	1/1994	Murphy et al.	714/778
5,285,474 A		2/1994	Chow et al.	
5,291,515 A		3/1994	Uchida et al.	
5,307,376 A		4/1994	Castelain et al.	
5,309,474 A		5/1994	Gilhousen et al.	
5,345,440 A		9/1994	Gledhill et al.	
5,357,541 A		10/1994	Cowart	
5,373,502 A		12/1994	Turban	
5,375,140 A		12/1994	Bustamante et al.	
5,414,734 A		5/1995	Marchetto et al.	
5,416,797 A		5/1995	Gilhousen et al.	
5,442,625 A		8/1995	Gitlin et al.	
5,467,367 A		11/1995	Izumi et al.	
5,469,469 A		11/1995	Haines	
5,479,447 A		12/1995	Chow et al.	
5,487,069 A		1/1996	O'Sullivan et al.	
5,550,812 A		8/1996	Philips	
5,596,601 A		1/1997	Bar-David	
5,615,209 A		3/1997	Bottomley	
5,623,511 A		4/1997	Bar-David et al.	
5,715,236 A		2/1998	Gilhousen et al.	
5,960,032 A		9/1999	Letaief et al.	

OTHER PUBLICATIONS

Proakis, J.G., *Digital Communication*, 2d ed., 1991, Chap. 8, "Spread Spectrum Signals for Digital Communications," pp. 800–891.

Gledhill, J.J., et al., "The Transmission of Digital Television In The UHF Band Using Orthogonal Frequency Division Multiplexing," pp. 175–180, No Date.

Duch, Krzysztof M., "Baseband Signal Processing," *Network Magazine*, pp. 39–43; Nov. 1991.

Ananasso, Fulvio, et al., "Clock Synchronous Multicarrier Demodulator For Multi–Frequency TDMA Communication Satellites," pp. 1059–1063; 1990.

Saito, Masafumi, et al., "A Digital Modulation Method For Terrestrial Digital TV Broadcasting Using Trellis Coded OFDM And Its Performance," pp. 1694–1698; Globecom '92 Conference; 1992.

Alard, M., et al., "A New System Of Sound Broadcasting To Mobile Receivers," pp. 416–420; 1988.

Chow, Jacky S., et al., "A Discrete Multitone Tranceiver System for HDSL Applications," pp. 895–908; "IEEE Journal on Selected Areas In Communications"; Aug. 1991.

Chow, Peter S., et al., "Performance Evaluation of a Multichannel Transceiver System for ADSL and VHDSL Services," pp. 909–919; IEEE Journal on Selected Areas in Communications; Aug. 1991.

Pupolin, Silvano, et al., "Performance Analysis Of Digital Radio Links With Nonlinear Transmit Amplifier And Data Predistorter With Memory," pp. 9.6.1–9.6.5; 1989.

Bingham, J.A.C.; "Multicarrier Modulation for Data Transmission: An Idea Whose Time Has Come", *IEEE Communications Magazine*, pp. 5–14, May 1990.

Spracklen, C.T. and C. Smythe, "The Application of Code Division Multiplexing Techniques to Local Area Networks," pp. 767–770, May 1987.

Scott L. Miller and Weerakhan Tantiphaiboontana, Code Division Multiplexing—Efficient Modulation for High Data Rate Transmission Over Wireless Channels, Proceedings of 2000 IEEE International Conference on Communications, pp. 1487–1491.

Shigenobu Sasaki, Jinkang Zhu, and Gen Marubayashi, Performance of Parallel Combinatory Spread Spectrum Multiple Access Communication Systems, Proceedings of 1991 IEEE International Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC), pp. 204–208.

Jinkang Zhu and Gen Marubayashi, Properties and Application of Parallel Combinatory SS Communication System, IEEE Second International Symposium on Spread Spectrum Techniques and Applications (ISSSTA '92), Yokohama, Japan, pp. 227–230, Nov. 29–Dec. 2, 1992.

K. Ben Letaief, J. C–I Chuang, and R.D. Murch, Multicode High–Speed Transmission for Wireless Mobile Communications, Proceedings of the 1995 IEEE Global Telecommunications Conference GLOBEOM'95, Singapore, pp. 1835–1839, Nov. 14–16, 1995.

Reduction of Multipath Fading Effects in Single Variable Modulations, M.A. Poletti and R.G. Vaughan, ISSPA 90 Signal Processing Theories, Implementations and Applications, Gold Coast, Australia Aug. 27–31, 1990, 672–676.

OFDM for Data Communication over Mobile Radio FM Channels; Part I: Analysis and Experimental Results, E.F. Casas and C. Leung, IEEE Transactions on Communications, vol. 39, No. 5, May 1991.

OFDM for Data Communication over Mobile Radio FM Radio Channels; Part II: *Performance Improvement*, E.F. Casas and C. Leung, Dept. of Electrical Engineering, University of British Columbia, Vancouver, BC, Canada, 1991.

Performance of an RCPC–Coded OFDM–Based Digital Audio Broadcasting (DAB) System, P. Hoeher, J. Hagenauer, E. Offer, Ch. Rapp, H. Schulze, Globecom '91, CH 2980–1/91/0000–0040, pp. 0040–0046.

The Multitone Channel, Irving Kalet, IEEE Transactions on Communications, vol. 37, No. 2, Feb. 1989.

Optimized Decision Feedback Equalization Versus Optimized Orthogonal Frequency Division Multiplexing for High–Speed Data Transmission Over the Local Cable Network, Nikolaos A. Zervos and Irving Kalet, CH2655–9/89/0000–1989 IEEE, pp. 1080–1085.

Advanced Groupband Data Modem Using Orthogonally Multiplexed QAM Technique, Botaro Hirosaki, Satoshi Hasegawa and Akio Sabato, IEEE Transactions on Communications, vol. Com–34, No. 6, Jun. 1996, pp. 587–592.

A 19.2 kbps Voiceband Data Modem Based on Orthogonally Multiplexed QAM Techniques, B. Hirosaki, A. Yoshida, O. Tanaka, S. Hasegawa, K. Inoue and K. Watanabe, CH2175–8/85/0000–0661 IEEE, pp. 661–665.

Analysis and Stimulation of a Digital Mobile Channel Using Orthogonal Frequency Division Multiplexing, Leonard J. Cimini, Jr., IEEE Transactions on Communications, vol. Comm–33, No. 7, Jul. 1985, pp. 665–675.

An Orthogonally Multiplexed QAM System Using the Discrete Fourier Transform, Botaro Hirosaki, IEEE Transactions on Communications, vol. Com–29, No. 7, Jul. 1981, pp. 982–989.

An Analysis of Automatic Equalizers of Orthogonally Multiplexed QAM Systems, Botaro Hirosaki, IEEE Transactions on Communications, vol. Com–28, No. 1, Jan. 1980, pp. 73–83.

An Improved Method for Digital SSB–FDM Modulation and Demodulation, Rikio Maruta and Atsushi Tomozawa, IEEE Transactions on Communications, vol. Com–26, No. 5, May 1978, pp. 720–725.

Data Transmission by Frequency–Division Multiplexing Using the Discrete Fourier Transform, S.B. Weinstein and Paul M. Ebert, IEEE Transactions on Communications, vol. Com–19, No. 5, Oct. 1971, pp. 628–634.

Performance of an Efficient Parallel Data Transmission System, Burton R. Saltzberg, IEEE Transactions on Communication Technology, vol. Com–15, No. 6, Dec. 1967, pp. 805–811.

A Theoretical Study of Performance of an Orthogonal Multiplexing Data Transmission Scheme, Robert W. Chang and Richard A. Gibby, IEEE Transactions on Communication Technology, vol. Com.–16, No. 4, Aug. 1968, pp. 529–540.

Synthesis of Band–Limited Orthogonal Signals for Multichannel Data Transmission, Robert W. Chang, The Bell System Technical Journal, Dec. 1966, pp. 1775–1796.

* cited by examiner

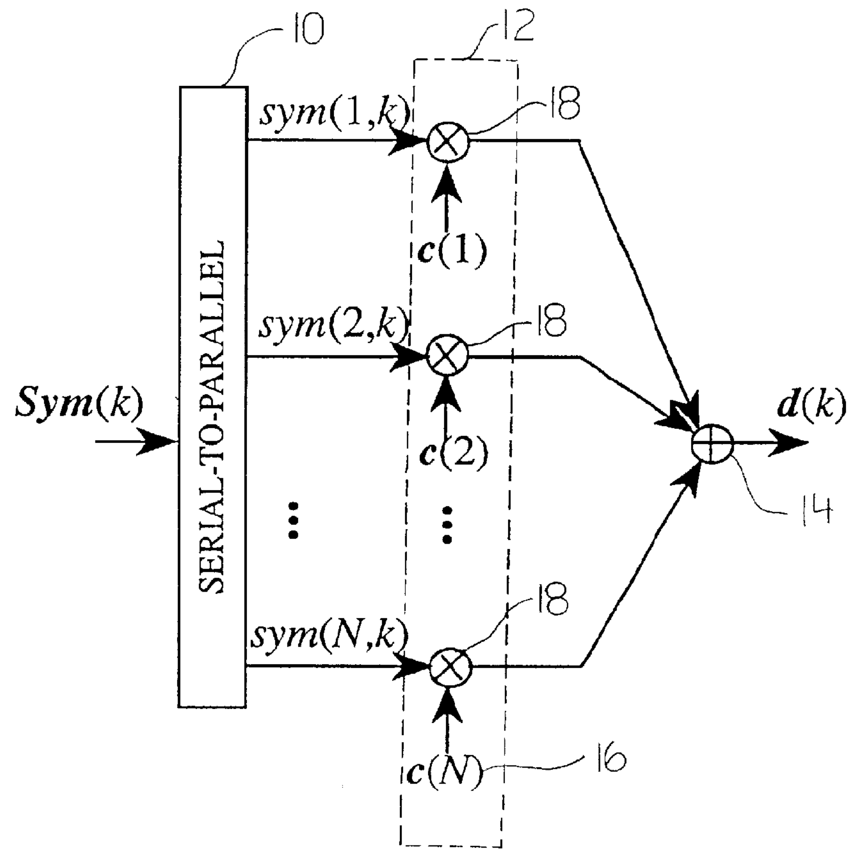
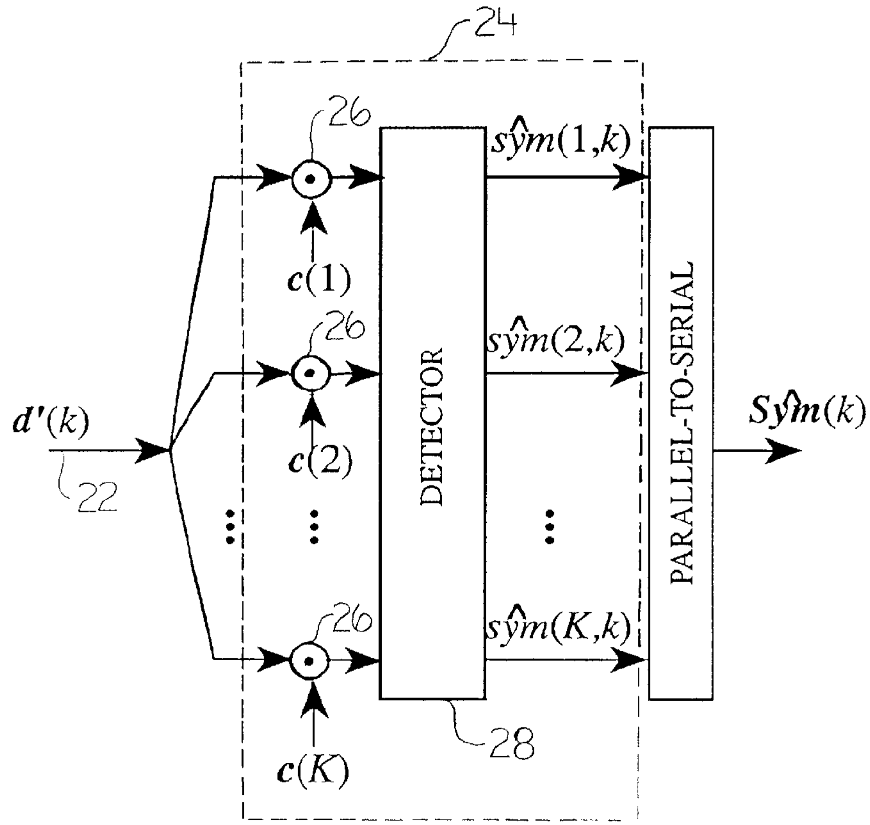

10
12
18
sym(1,k)
c(1)
sym(2,k)
c(2)
Sym(k)
SERIAL-TO-PARALLEL
d(k)
14
sym(N,k)
c(N)
16

FIGURE 1



24
26
26
26
$c(1)$
$c(2)$
$c(K)$
$d'(k)$
22
DETECTOR
28
$s\hat{y}m(1,k)$
$s\hat{y}m(2,k)$
$s\hat{y}m(K,k)$
PARALLEL-TO-SERIAL
$S\hat{y}m(k)$

FIGURE 2

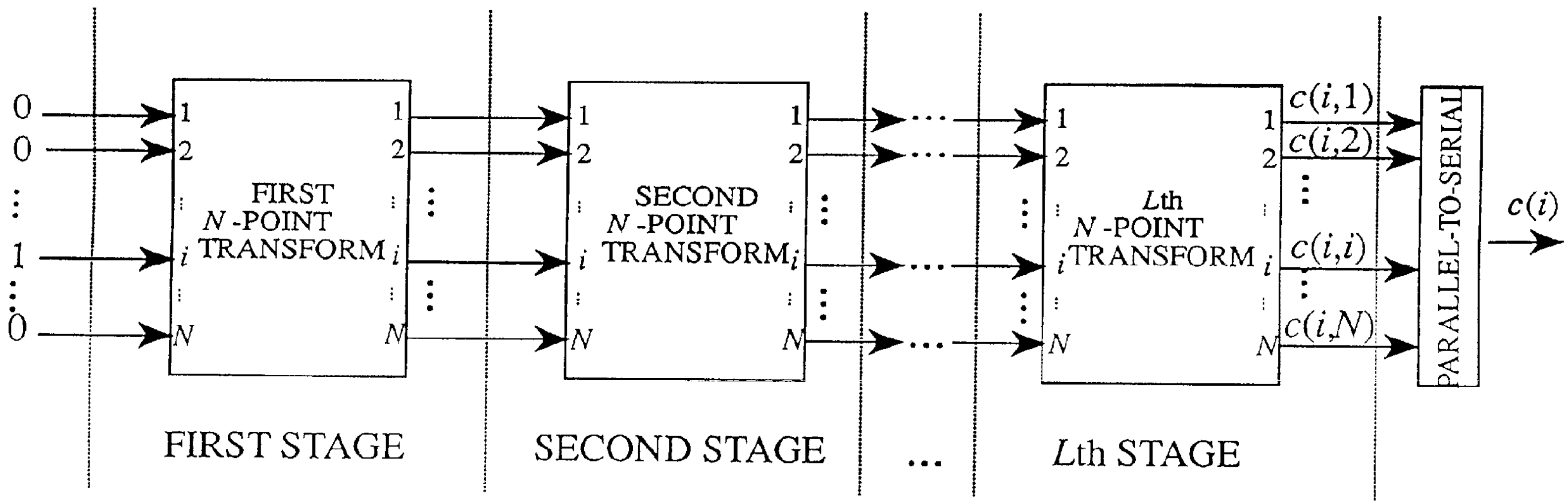

0
0
1
0
FIRST N-POINT TRANSFORM
SECOND N-POINT TRANSFORM
Lth N-POINT TRANSFORM
c(i,1)
c(i,2)
c(i,i)
c(i,N)
PARALLEL-TO-SERIAL
c(i)
FIRST STAGE
SECOND STAGE
...
Lth STAGE

FIGURE 3

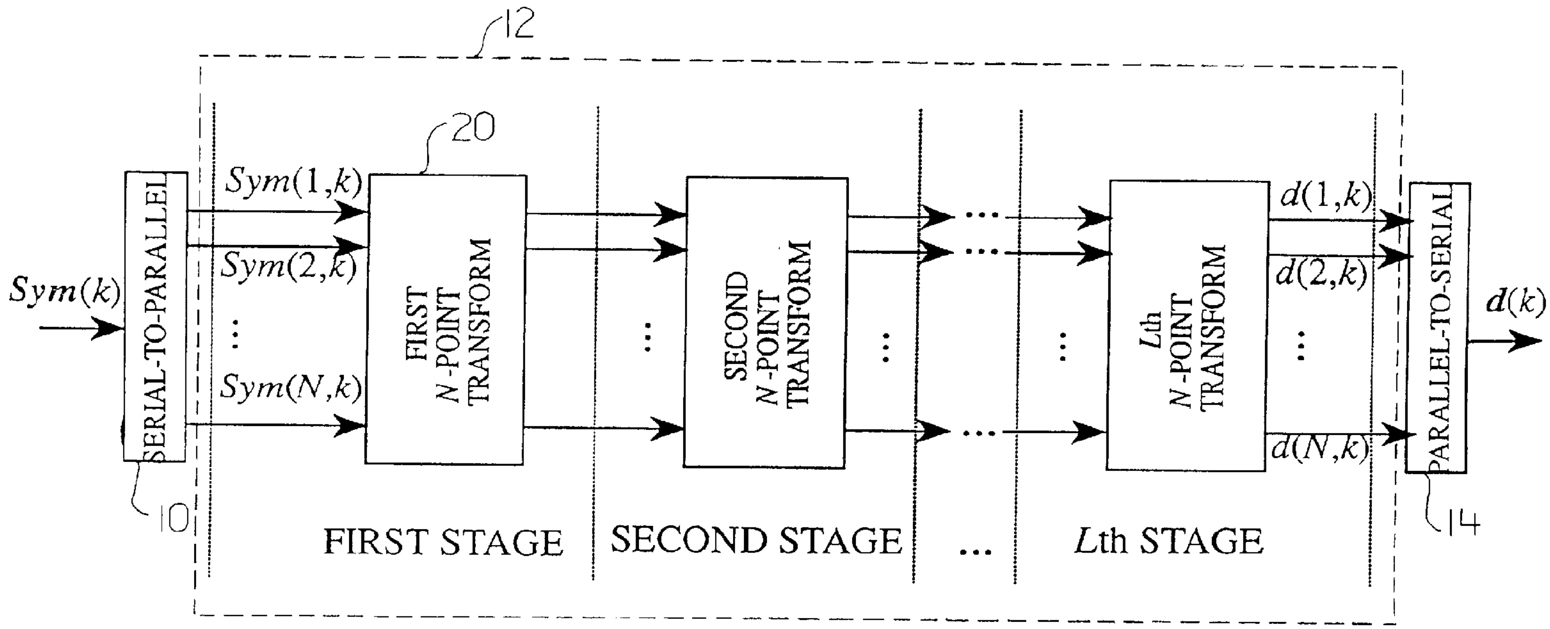

12
20
Sym(k)
SERIAL-TO-PARALLEL
Sym(1,k)
Sym(2,k)
Sym(N,k)
FIRST N-POINT TRANSFORM
SECOND N-POINT TRANSFORM
Lth N-POINT TRANSFORM
d(1,k)
d(2,k)
d(N,k)
PARALLEL-TO-SERIAL
d(k)
10
14
FIRST STAGE
SECOND STAGE
...
Lth STAGE

FIGURE 4

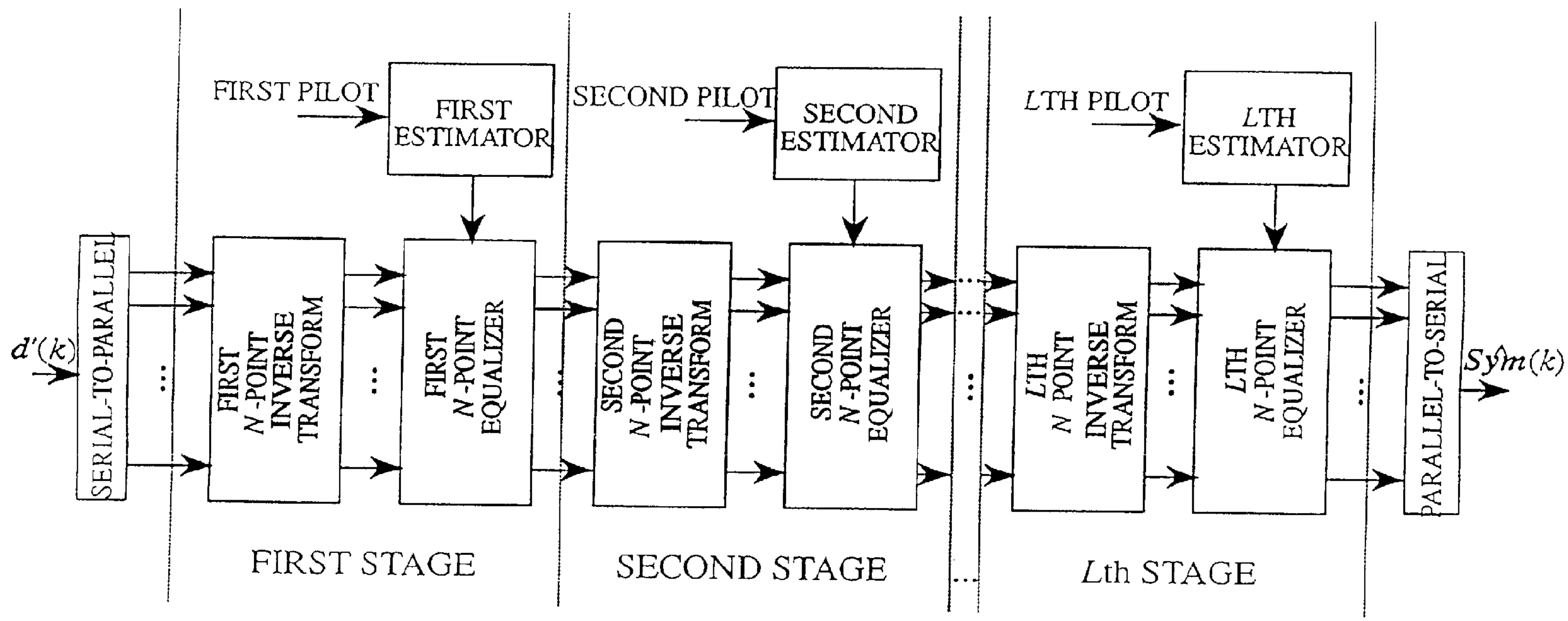

FIRST PILOT
FIRST ESTIMATOR
SECOND PILOT
SECOND ESTIMATOR
LTH PILOT
LTH ESTIMATOR
d'(k)
SERIAL-TO-PARALLEL
FIRST N-POINT INVERSE TRANSFORM
FIRST N-POINT EQUALIZER
SECOND N-POINT INVERSE TRANSFORM
SECOND N-POINT EQUALIZER
LTH N POINT INVERSE TRANSFORM
LTH N-POINT EQUALIZER
PARALLEL-TO-SERIAL
Sym(k)
FIRST STAGE
SECOND STAGE
Lth STAGE

FIGURE 5

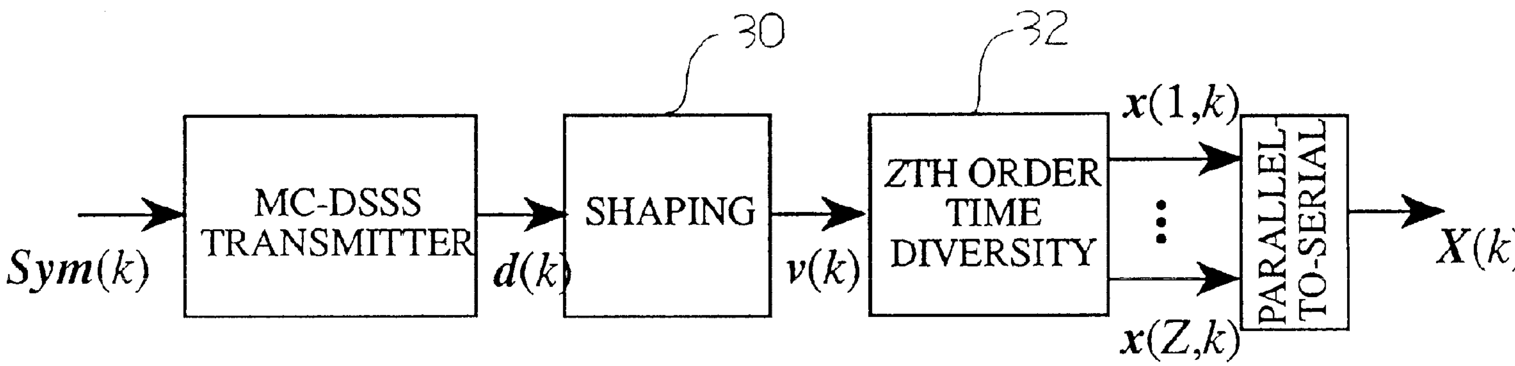

30
32
MC-DSSS TRANSMITTER
SHAPING
ZTH ORDER TIME DIVERSITY
PARALLEL-TO-SERIAL
Sym(k)
d(k)
v(k)
x(1,k)
x(Z,k)
X(k)

FIGURE 6

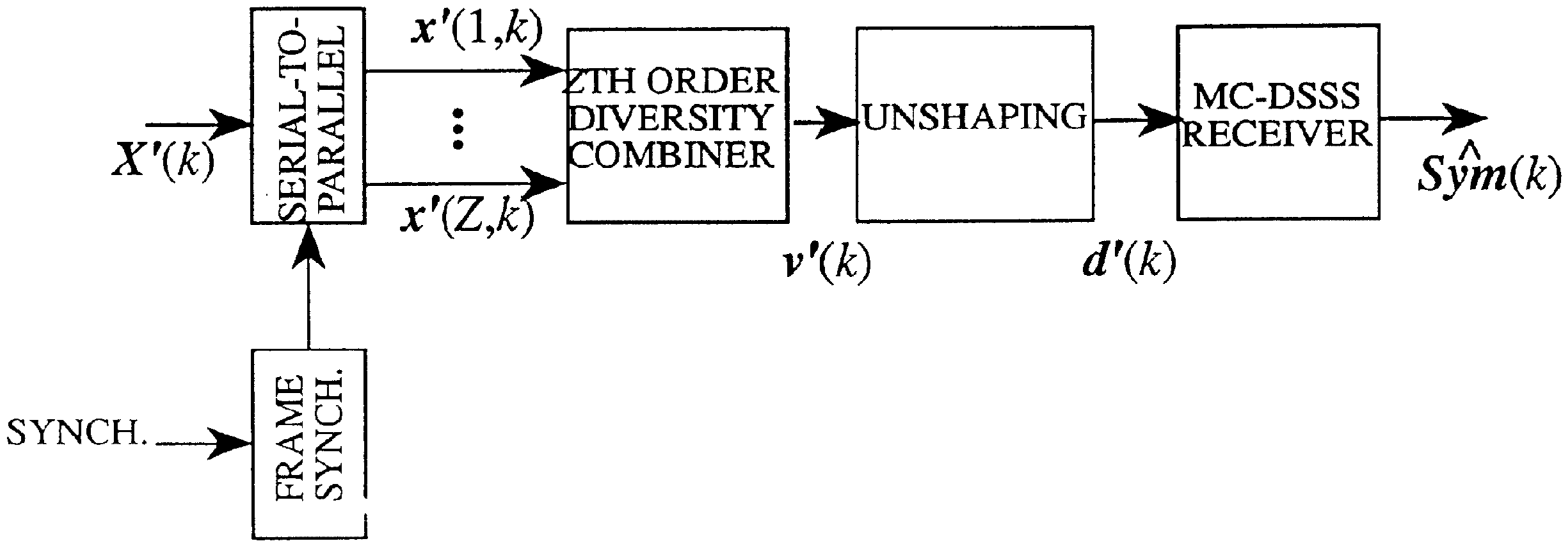

SERIAL-TO-
PARALLEL
$X'(k)$
$x'(1,k)$
$x'(Z,k)$
ZTH ORDER
DIVERSITY
COMBINER
$v'(k)$
UNSHAPING
$d'(k)$
MC-DSSS
RECEIVER
$S\hat{y}m(k)$
SYNCH.
FRAME
SYNCH.

FIGURE 7

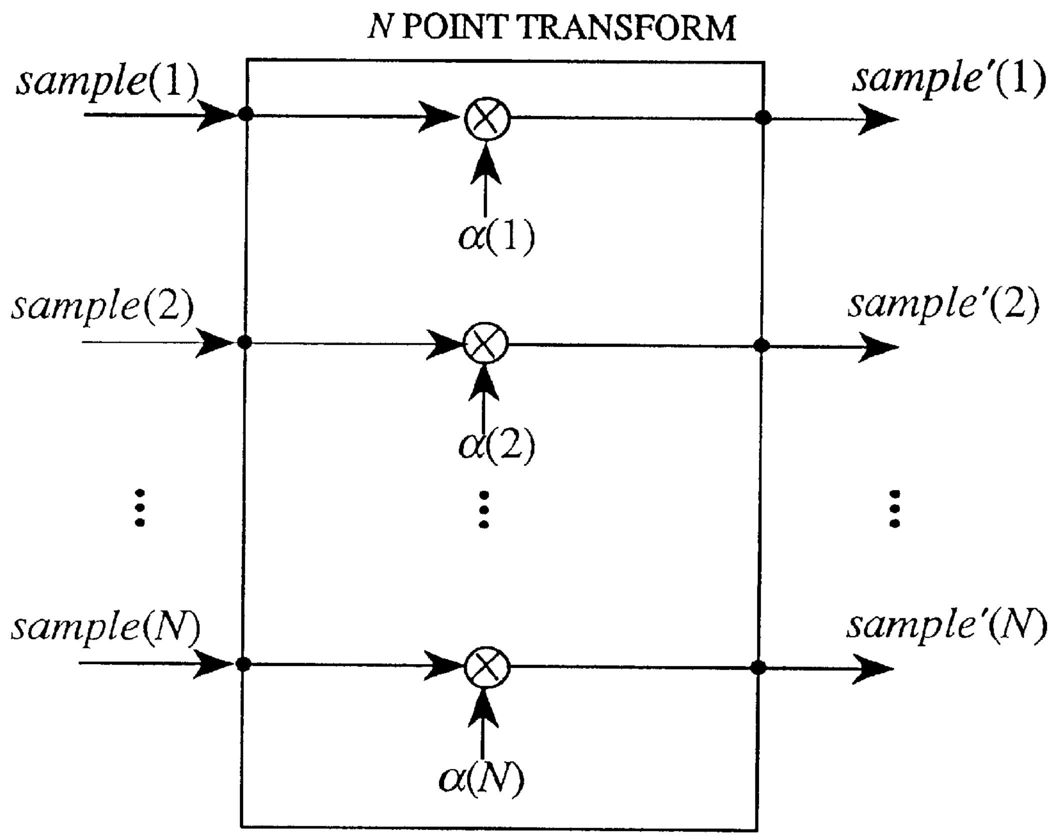

N POINT TRANSFORM
sample(1)
sample(2)
sample(N)
α(1)
α(2)
α(N)
sample'(1)
sample'(2)
sample'(N)

FIGURE 8

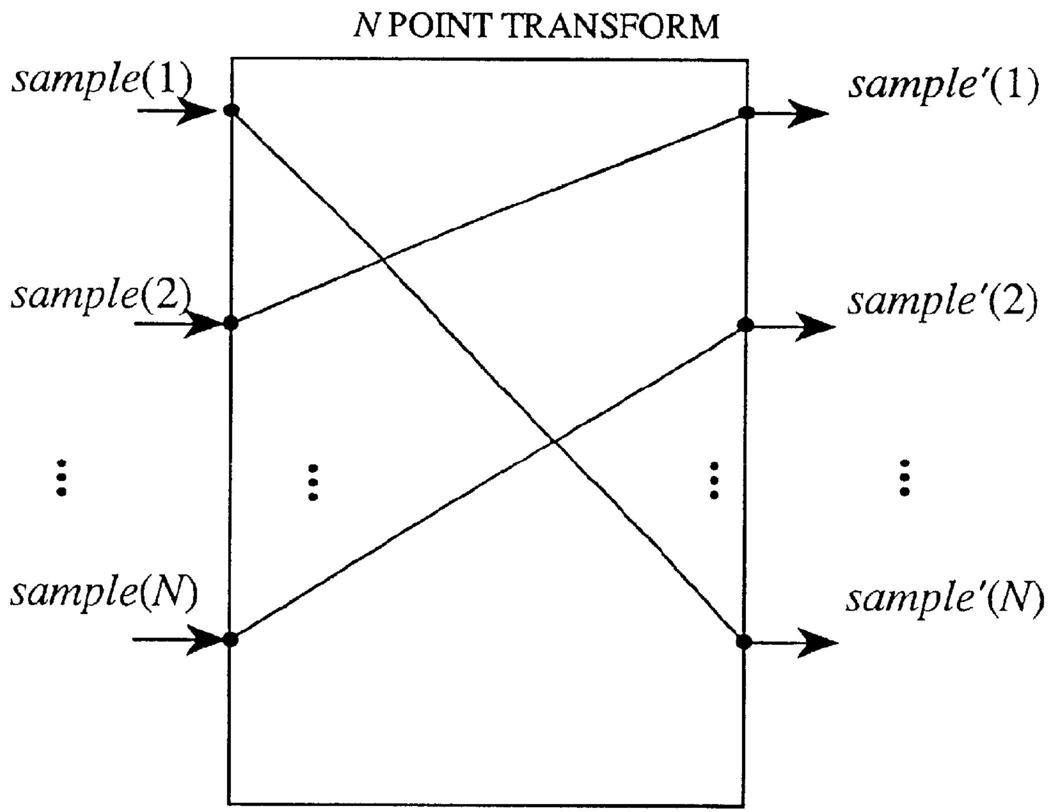

N POINT TRANSFORM
sample(1)
sample(2)
sample(N)
sample'(1)
sample'(2)
sample'(N)

FIGURE 9

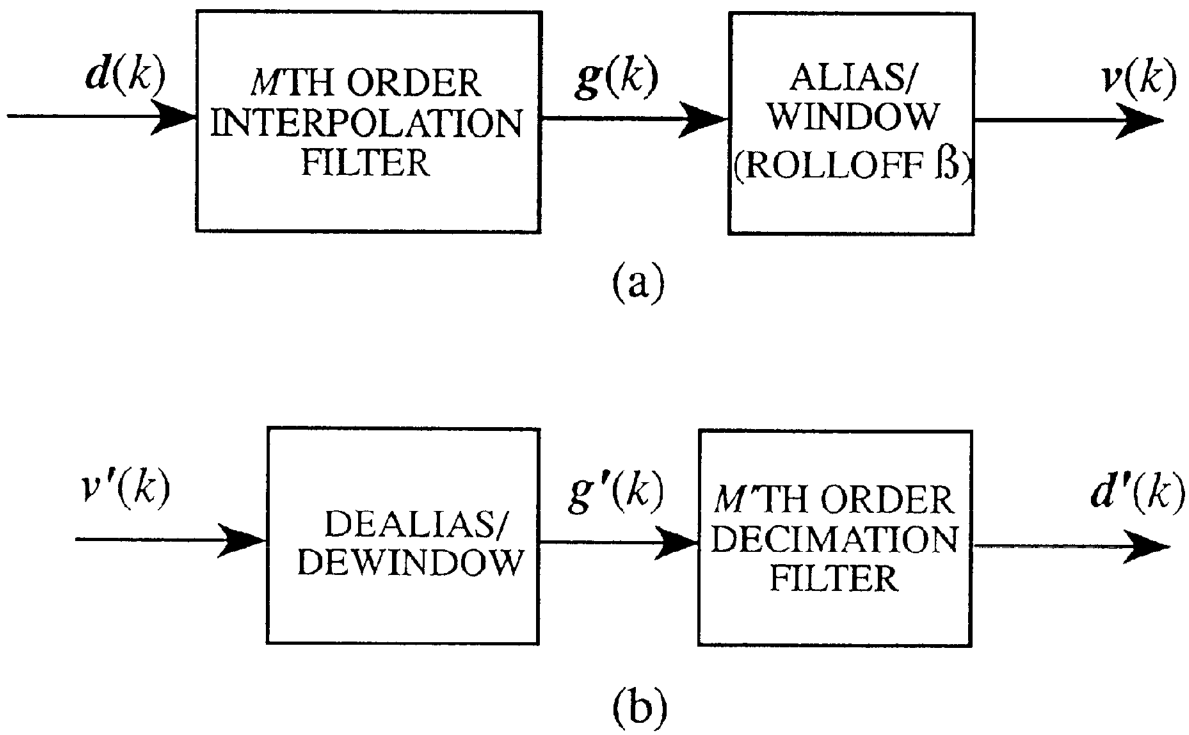

d(k)
MTH ORDER INTERPOLATION FILTER
g(k)
ALIAS/ WINDOW (ROLLOFF ß)
v(k)
(a)
v'(k)
DEALIAS/ DEWINDOW
g'(k)
M'TH ORDER DECIMATION FILTER
d'(k)
(b)

FIGURE 10

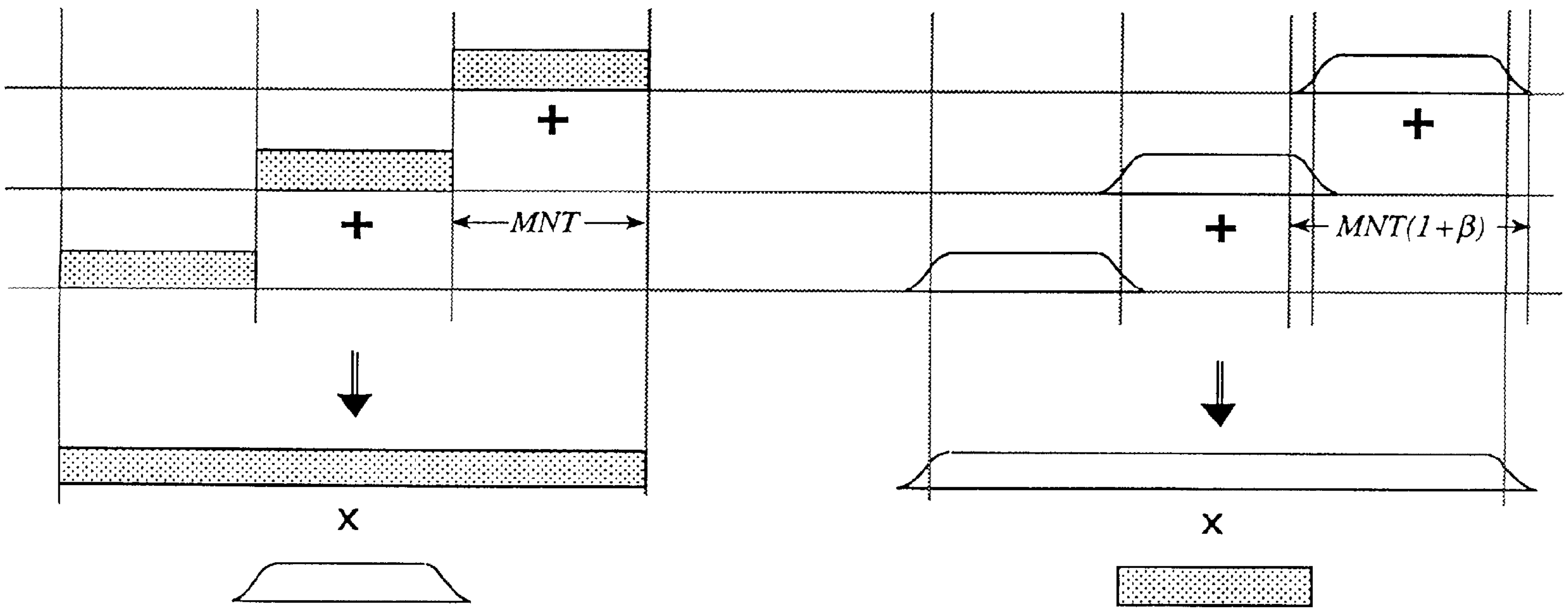


FIGURE 11

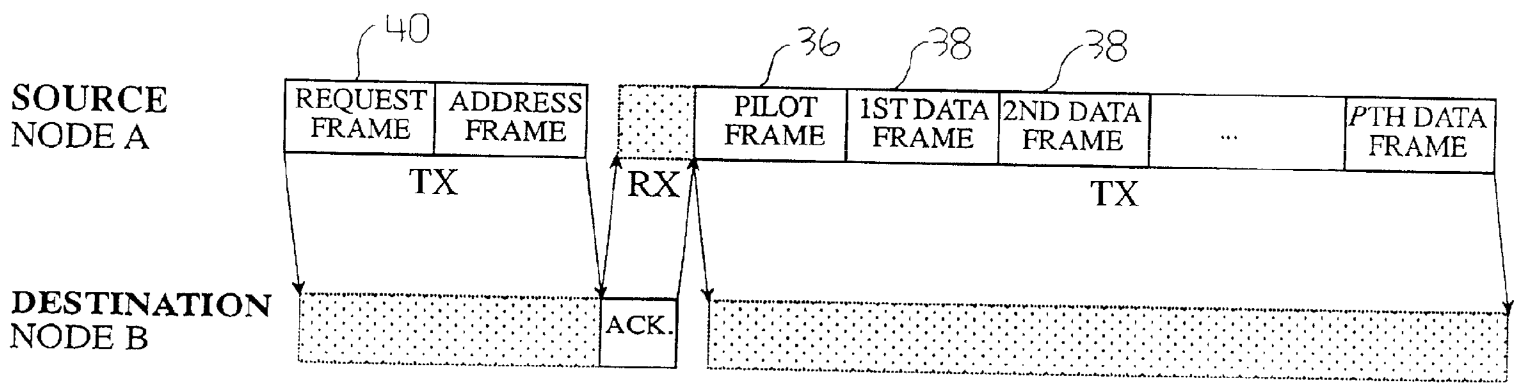

40
36
38
38
SOURCE NODE A
REQUEST FRAME
ADDRESS FRAME
PILOT FRAME
1ST DATA FRAME
2ND DATA FRAME
...
PTH DATA FRAME
TX
RX
TX
DESTINATION NODE B
ACK.

FIGURE 12

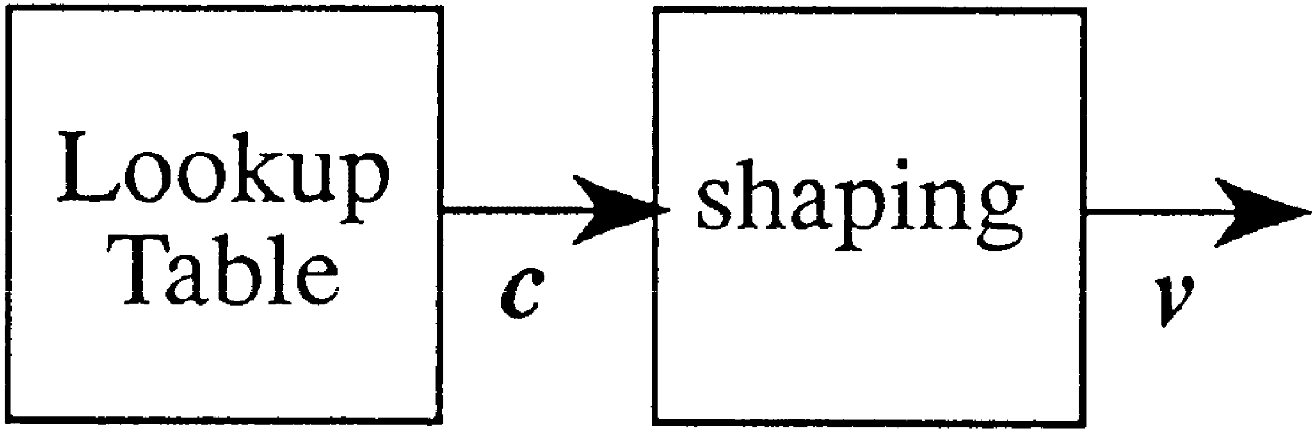


FIGURE 13

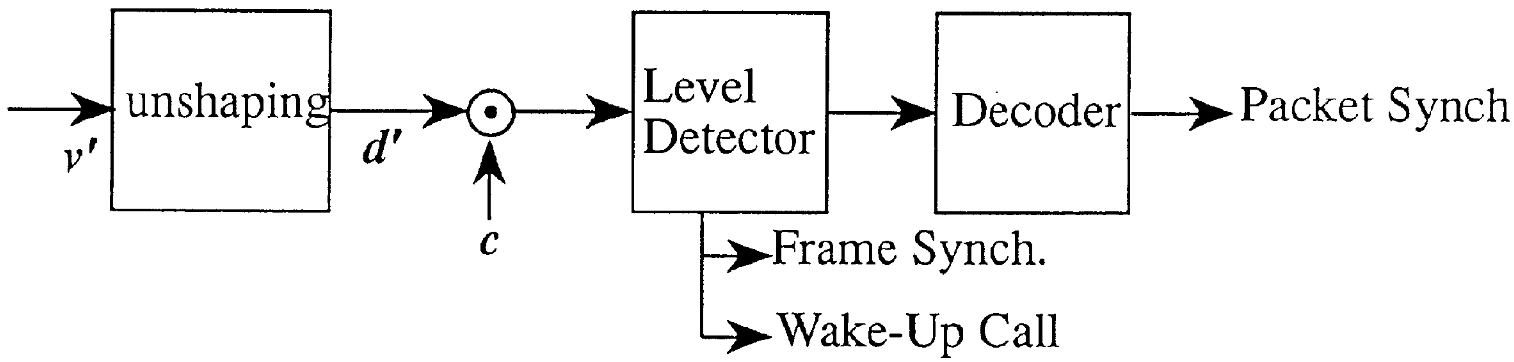

unshaping
v'
d'
c
Level Detector
Decoder
Packet Synch.
Frame Synch.
Wake-Up Call

FIGURE 14

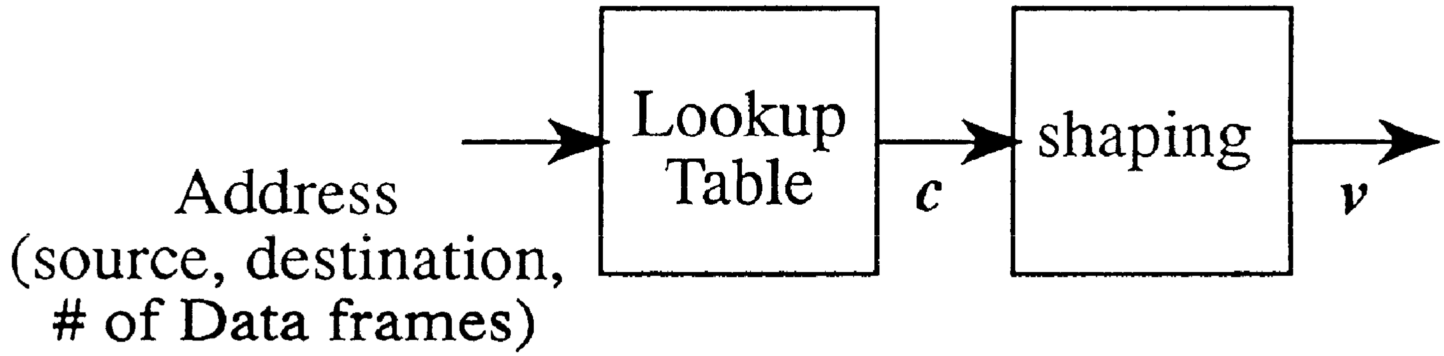

Address
(source, destination,
# of Data frames)
Lookup
Table
c
shaping
v

FIGURE 15

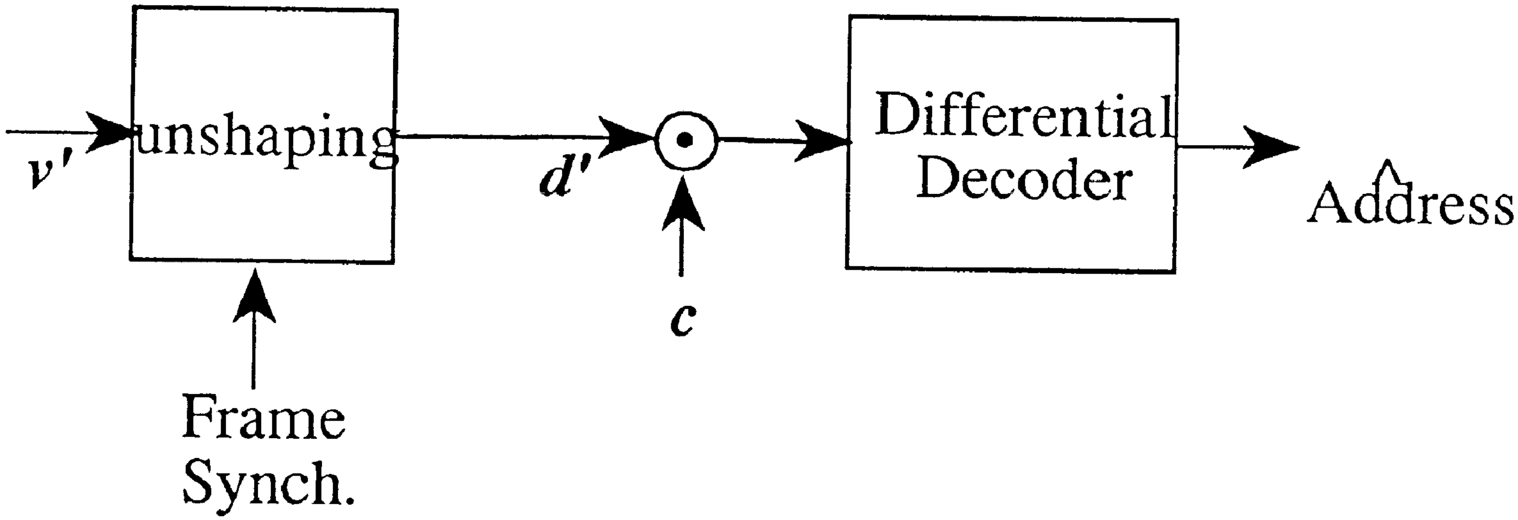


FIGURE 16

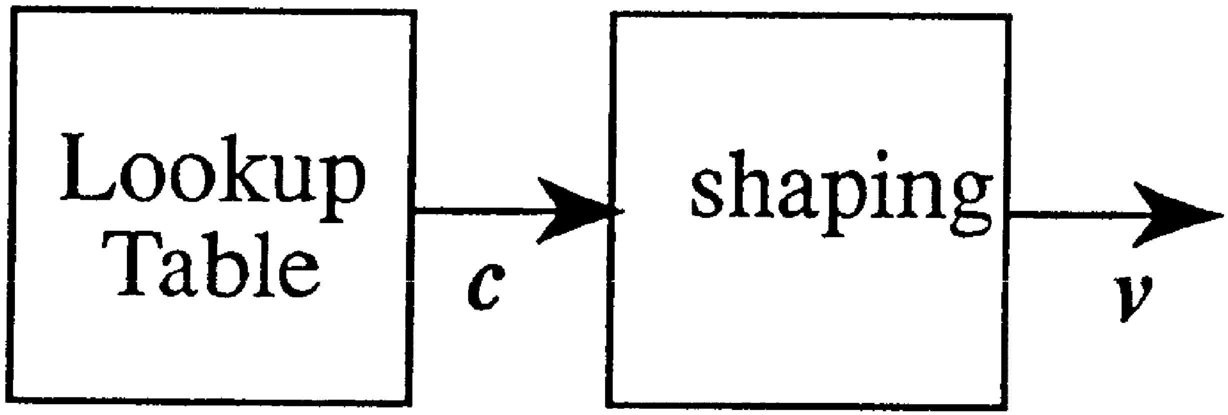


FIGURE 17

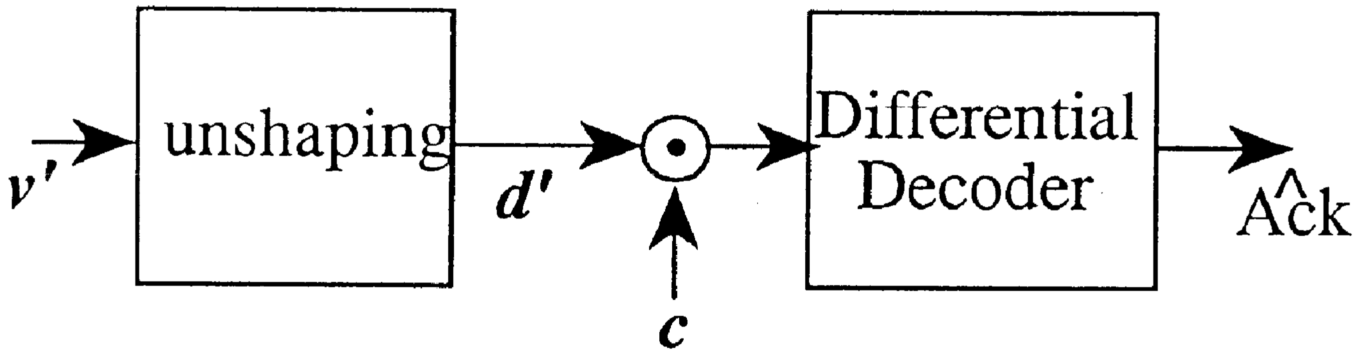


FIGURE 18

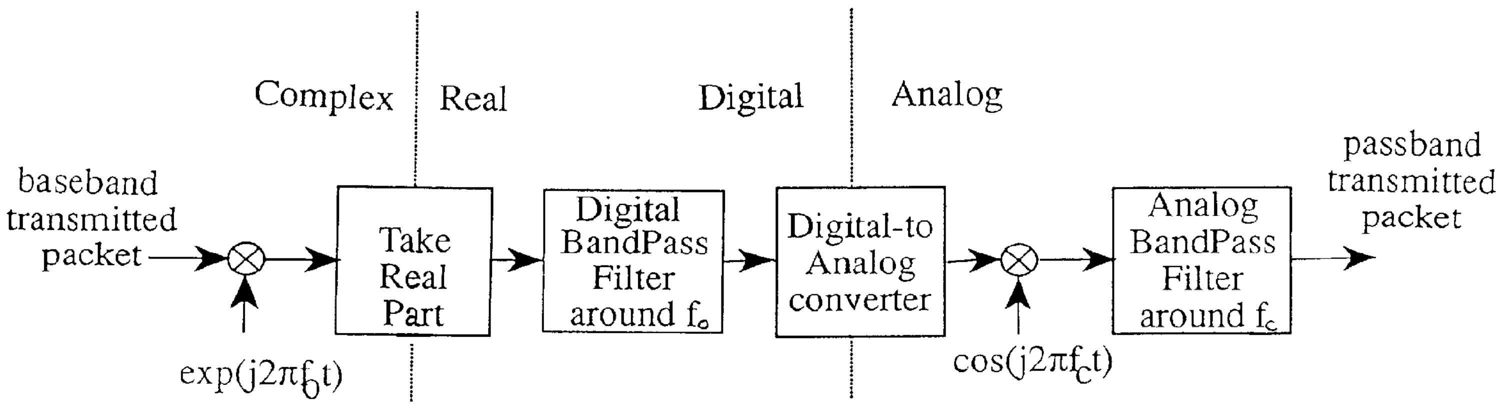

Complex
Real
Digital
Analog
baseband transmitted packet
Take Real Part
Digital BandPass Filter around f_o
Digital-to Analog converter
Analog BandPass Filter around f_c
passband transmitted packet
$\exp(j2\pi f_0 t)$
$\cos(j2\pi f_c t)$

FIGURE 19

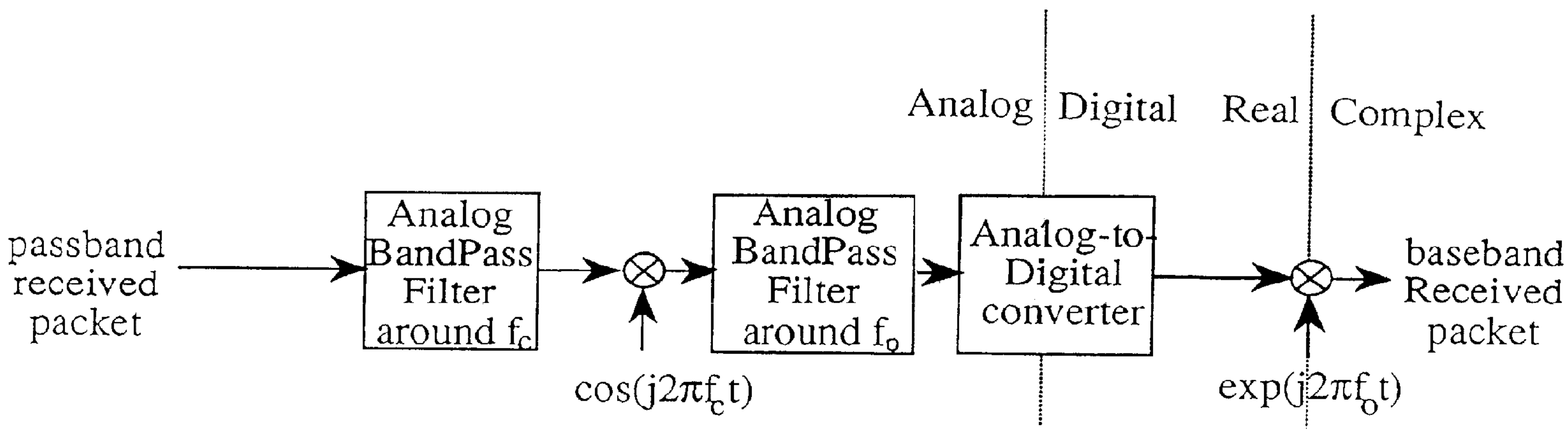

Analog
Digital
Real
Complex
passband received packet
Analog BandPass Filter around f_c
$\cos(j2\pi f_c t)$
Analog BandPass Filter around f_o
Analog-to-Digital converter
$\exp(j2\pi f_o t)$
baseband Received packet

FIGURE 20

MULTICODE DIRECT SEQUENCE SPREAD SPECTRUM

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

This application is a REISSUE of Ser. No. 08/186,784 filed Jan. 24, 1994 is a continuation-in-part of U.S. application Ser. No. 07/861,725 filed Mar. 31, 1992, now U.S. Pat. No. 5,282,222, the benefit of the filing date of which is hereby claimed under 35 U.S.C. §120.

FIELD OF THE INVENTION

The invention deals with the field of multiple access communications using Spread Spectrum modulation. Multiple access can be classified as either random access, polling, TDMA, FDMA, CDMA or any combination thereof. Spread Spectrum can be classified as Direct Sequence, Frequency-Hopping or a combination of the two.

BACKGROUND OF THE INVENTION

Commonly used spread spectrum techniques are Direct Sequence Spread Spectrum (DSSS) and Code Division Multiple Access (CDMA) as explained in Chapter 8 of "Digital Communication" by J. G. Proakis, Second Edition, 1991, McGraw Hill, DSSS is a communication scheme in which information bits are spread over code bits (generally called chips). It is customary to use noise-like codes called pseudo random noise (PN) sequences. These PN sequences have the property that their auto-correlation is almost a delta function and their cross-correlation with other codes is almost null. The advantages of this information spreading are:

1. The transmitted signal can be buried in noise and thus has a low probability of intercept.
2. The receiver can recover the signal from interferers (such as other transmitted codes) with a jamming margin that is proportional to the spreading code length.
3. DSSS codes of duration longer than the delay spread of the propagation channel can lead to multipath diversity implementable using a Rake receiver.
4. The FCC and the DOC have allowed the use of unlicensed low power DSSS systems of code lengths greater than or equal to 10 in some frequency bands (the ISM bands).

It is the last advantage (i.e., advantage 4. above) that has given much interest recently to DSSS.

An obvious limitation of DSSS systems is the limited throughput they can offer. In any given bandwidth, B, a code of length N will reduce the effective bandwidth to B/N. To increase the overall bandwidth efficiency, system designers introduced Code Division Multiple Access (CDMA) where multiple DSSS communication links can be established simultaneously over the same frequency band provided each link uses a unique code that is noise-like. CDMA problems are:

1. The near-far problem: a transmitter "near" the receiver sending a different code than the receiver's desired code produces in the receiver a signal comparable with that of a "far" transmitter sending the desired code.
2. Synchronization of the receiver and the transmitter is complex (especially) if the receiver does not know in advance which code is being transmitted.

SUMMARY OF THE INVENTION

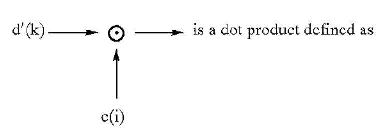
We have recognized that low power DSSS systems complying with the FCC and the DOC regulations for the ISM bands would be ideal communicators provided the problems of CDMA could be resolved and the throughput could be enhanced. To enhance the throughput, we allow a single link (i.e., a single transceiver) to use more than one code at the same time. To avoid the near-far problem only one transceiver transmits at a time. In this patent, we present Multi-Code Direct Sequence Spread Spectrum (MC-DSSS) which is a modulation scheme that assigns up to N codes to an individual transceiver where N is the number of chips per DSSS code. When viewed as DSSS, MC-DSSS requires up to N correlators (or equivalently up to N Matched Filters) at the receiver with a complexity of the order of N^2 operations. When N is large, this complexity is prohibitive. In addition, a nonideal communication channel can cause InterCode Interference (ICI), i.e., interference between the N DSSS codes at the receiver. In this patent, we introduce new codes, which we refer to as "MC" codes. Such codes allow the information in a MC-DSSS signal to be decoded in a sequence of low complexity parallel operations while reducing the ICI. In addition to low complexity decoding and ICI reduction, our implementation of MC-DSSS using the MC codes has the following advantages:

1. It does not require the stringent synchronization DSSS requires. Conventional DSSS systems requires synchronization to within a fraction of a chip whereas MC-DSSS using the MC codes requires synchronization to within two chips.
2. It does not require the stringent carrier recovery DSSS requires. Conventional DSSS requires the carrier at the receiver to be phase locked to the received signal whereas MC-DSSS using the MC codes does not require phase locking the carriers. Commercially available crystals have sufficient stability for MC-DSSS.
3. It is spectrally efficient.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic showing for the Baseband Transmitter for the xth MC-DSSS frame: d(k)=[d(1,x) d(2,x) . . . d(N,k)] where c(i)=[c(1,i) c(2,i)] is the ith code and Sym (k)=[sym(1,k) sym(N,k)] is the kth information-bearing vector containing N symbols.

FIG. **2** is a schematic showing a Baseband Receiver for the kth received MC-DSSS frame: d'(k)=[d'(1,k) d'(2,k) . . . d'(N,k)] where c(i)=[c(1,i) c(2,i) . . . c(N,i)] is the ith code, $Sy\hat{m}(k)$=[$sy\hat{m}(1,k)$ $sy\hat{m}(2,k)$ . . . $sy\hat{m}(N,k)$] is the estimate of the Kth information-bearing vector Sym(k) and



$$d'(k) \odot c(i) = c(1,i)d'(1,k) = c(2,i)d'(2,k) + \ldots + c(N,i)d'(N,N).$$

FIG. **3** is a schematic showing of the ith MC code c(i)=[c(i,1) c(i,2) . . . c(i,NO) where i can take one of the N values: 1,2, . . . N corresponding to the position of the single '1' at the input of the first N-point transform.

FIG. **4** is a schematic showing the alternate transmitter for the kth MC-DSSS frame: d(k)=[d(1,k), d(2,k) . . . d(N,k)] using the MC codes generated in FIG. **3** where Sym(k)=[Sym(1,k)Sym(2k) . . . Sym(N,k)] is the kth information-bearing vector contacting N symbols.

FIG. **5** is the alternate receiver for the kth received MC-DSSS frame d'(k)=[d'(1k)d'(2,K) . . .d'(N,k)] using MC codes generated in FIG. **3** where $Sy\hat{m}(k)$=[$sy\hat{m}(1,k)$ $sy\hat{m}(2k)$ . . . $sy\hat{m}(N,k)$] is the estimate of the information-bearing vetor Sym(k).

FIG. **6** is a schematic showing the Baseband Transmitter of the kth Data Frame X(k) where Sym(N)=[sym(1,k) sym (2,k) . . . sym(N,k)] is the kth information-bearing vector d(k)=[c(1,k) d(2,k) . . . d(N,k)] is the kth MC-DSSS frame v(k)=[v(1,k) v(2,k) . . . v((1+β)MN,k)], β∊(0,1), M=1,2,3 . . . and X(k)=[x(1k) x(2,k)], Z=Z=1, 2, 3, ...

FIG. **7** is a schematic showing the Baseband Receiver for the kth received Data Frame X'(k) where Sym̂(N)=[sym̂ (1,k)] sym̂(2,k) . . . sym̂(N,k)] is the estimate of the kth information-bearing vector d'(k)=[d'(1,k) d'(2k) . . . d'(N,k)] is the kth received MC-DSSS frame v'(k)=[v'(1,k) v(2k) . . . v'((1+β) MN,k)], B∊(0,1), M=1,2,3, . . . and X'(k)=[x'(1,k) x'(2,k) . . . r'(Z,k)], Z=1,2,3 . . . .

FIG. **8** is a schematic showing the Randomizer Transform (RT) where a (1) a (2) . . . a (N) are complex constants chosen randomly.

FIG. **9** is a schematic showing the Permutation Transform (PT).

FIG. **10** is a schematic showing (a) the shaping of a MC-DSSS frame and (b) the unshaping of a MC-DSSS frame where d(k)=[d(1,k) d(2,k) . . . d(N,k)] is the kth MC-DSSS frame g(k)=[g(1,k) g(2k) . . . g(MN,k)], M=1,2,3, . . . , v(k)=[v(1,k) v(2,k) . . . v((1+β) MN,k)], B∊(0,1) d'(k)=[d(1,k) d(2,k) . . . d(N,K)] is the kth received MC-DSSS frame g'(k)=[g'(1,k) g'(2,k) . . . g'(M'N,k)] and v'(k)=[v(1,k) v'(2,k) . . . v'((1+β) M'N,k)], M'=1,2,3, ...

FIG. **11** is a schematic showing (a) Description of the alias/window operation (b) Description of dealias/dewindow operation, where 1/T is the symbol rate.

FIG. **12** is a schematic showing the frame structure for data transmission from source (Node A) to destination (Node B).

FIG. **13** is a schematic showing the baseband transmitter for one request frame v where c=[c(1) c(2) . . . c(1)] is the DSSS code, v=[v(1) v(2) . . . v((1+β)MI)], β∊(0,1), M=1,2, . . . and I is the length of the DSSS code.

FIG. **14** is a schematic showing the baseband receiver for the received request frame where c=[c(1) c(2) . . . c(1)] is the DSSS code for the request frame, d'=[d(1) d(2) . . . d(1)] is the received request frame, v'=[v'(1) v'((1+β) MI)], β∊(0,1), M=1,2, . . . and l is the length of the DSSS code.

FIG. **15** is a schematic showing the baseband transmitter for one address frame where c=[c(1) c(2) . . . c(1)] is the CDMA code for the address frame, v=[v(1) v(2) . . . v(1+β) MI)], β∊(0,1), M=1,2, . . . and l' is the length of the CDMA code.

FIG. **16** is a schematic showing the baseband receiver the address where c=[c(1) c(2) . . . c(I')] is the CDMA code for the address frame, d'=[d(1) d(2) . . . d(I)] is the received address frame, v'[v'(1) v'(2) . . . v'((1+β) MI')], β∊(0,1), M=1,2, . . . and I' is the length of the CDMA code.

FIG. **17** is a schematic showing the baseband transmitter for Ack. Frame where c=[c(1) c(2) . . . c(I')] is the DSSS code for the Ack. frame, v=[v(1) v(2) . . . v((I+β) MI')] β∊(0,1), M=1,2,3, . . . and I' is the length of the DSSS code.

FIG. **18** is a schematic showing the baseband receiver for the ack. frame where c=[c(1) c(2) . . . c(I")] is the DSSS code for the Ack. frame, d'=[d(1) d(2) . . . d'(I")] is the received Ack. frame, v'=[v'(1) v(2) . . . v'(1+β) MI")], β∊(0,1), M=1,2, . . . and I" is the length of the DSSS code.

FIG. **19** is a schematic showing the passband transmitter for a packet where f_o is the IF frequency and f_o+f_c is the RF frequency.

FIG. **20** is a schematic showing the passband receiver for a packet where f_o is the IF frequency and f_o+f_c is the RF frequency.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS OF THE INVENTION

FIG. **1** illustrates the transmitter of the MC-DSSS modulation technique generating the kth MC-DSSS frame bearing N symbols of information. The symbols can be either analog or digital.

A converter **10** converts a stream of data symbols into plural sets of N data symbols each. A computing means **12** operates on the plural sets of N data symbols to produce modulated data symbols corresponding to an invertible randomized spreading of the stream of data symbols. A combiner **14** combines the modulated data symbols for transmission. The computing means shown in FIG. **1** includes a source **16** of N direct sequence spread spectrum code symbols and a modulator **18** to modulate each ith data symbol from each set of N data symbols with the I code symbol from the N code symbol to generate N modulated data symbols, and thereby spread each I data symbol over a separate code symbol.

FIG. **2** illustrates the receiver of the MC-DSSS modulation techniques accepting the kth MC-DSSS frame and generating estimates for the corresponding N symbols of information. The dot product in FIG. **2** can be implemented as a correlator. The detector can make either hard decisions or soft decisions.

A sequence of modulated data symbols is received at **22** in which the sequence of modulated data symbols has been generated by the transmitter such as is shown in FIG. **1** or **4**. A second computing means **24** operates on the sequence of modulated data symbols to produce an estimate of the second string of data symbols. The computing means **24** shown in FIG. **2** includes a correlator **26** for correlating each I modulated data symbol from the received sequence of modulated data symbols with the I code symbol from the set of N code symbols and a detector **28** for detecting an estimate of the data symbols from output of the correlator **26**.

FIG. **3** illustrates the code generator of the MC codes. Any one of the P N-point transforms in FIG. **3** consists of a reversible transform to the extent of the available arithmetic precision. In other words, with finite precision arithmetic, the transforms are allowed to add a limited amount of irreversible error.

One can use the MC-DSSS transmitter in FIG. **1** and the MC-DSSS receiver in FIG. **2** together with the MC codes generated using the code generator in FIG. **3** in order to implement MC-DSSS using the MC codes.

An alternative transmitter to the one in FIG. **1** using the MC codes in FIG. **3** is shown in FIG. **4**.

The alternative transmitter shown in FIG. **4** includes a transformer **20** for operating on each set of N data symbols to generate N modulated data symbols as output. A series of transforms are shown.

An alternative receiver to the one in FIG. **2** using the MC codes in FIG. **3** is shown in FIG. **5**. L pilots are required in FIG. **5** for equalization.

Both transmitters in FIGS. **1** and **4** allow using shaper **30** in diversity module **32** shaping and time diversity of the MC-DSSS signal as shown in FIG. **6**. We will refer to the MC-DSSS frame with shaping and time diversity as a Data frame.

Both receivers in FIGS. **2** and **5** allow diversity combining followed by the unshaping of the Data frame as shown in FIG. **7**. A Synch. is required in FIG. **7** for frame synchronization.

In addition to the Data frames, we need to transmit (1) all of the L pilots used in FIG. **5** to estimate and equalize for the various types of channel distortions, (2) the Synch. signal used in FIG. **7** for frame synchronization, and (3) depending on the access technique employed, the source address, destination address and number of Data frames. We will refer to the combination of all transmitted frames as a packet.

PREFERRED EMBODIMENTS OF THE INVENTION

Examples of the N-point transforms in FIG. **3** are a Discrete Fourier Transform (DFT), a Fast Fourier Transform

(FFT), a Walsh Transform (WT), a Hilbert Transform (HT), a Randomizer Transform (RT) as the one illustrated in FIG. **8**, a Permutator Transform (PT) as the one illustrated in FIG. **9**, an Inverse DFT (IDFT), an Inverse FFT (IFFT), an Inverse WT (IWT), an Inverse HT (IHT), an Inverse RT (IRT), an Inverse PT (IPT), and any other reversible transform. When L=2 with the first N-point transform being a DFT and the second being a RT, we have a system identical to the patent: "Method and Apparatus for Multiple Access between Transceivers in Wireless Communications using OFDM Spread Spectrum" by M. Fattouche and H. Zaghloul, filed in the U.S. Pat Office in Mar. 31, 1992, Ser. No. 07/861,725.

Preferred shaping in FIG. **6** consists of an Mth order interpolation filter followed by an alias/window operation as shown in FIG. **10**a. The Alias/window operation is described in FIG. **11**a where a raised-cosine pulse of rolloff β is applied. The interpolation filter in FIG. **10**a can be implemented as an FIR filter or as an NM-point IDFT where the first N(M−1)/2 points and the last N(M−1)/2 points at the input of the IDFT are zero. Preferred values of M are 1,2,3 and 4.

Preferred unshaping in FIG. **7** consists of a dealias/dewindow operation followed by a decimation filter as shown in FIG. **10**b. The dealias/dewindow operation is described in FIG. **11**b.

Time Diversity in FIG. **6** can consist of repeating the MC-DSSS frame several times. It can also consist of repeating the frame several times then complex conjugating some of the replicas, or shifting some of the replicas in the frequency domain in a cyclic manner.

Diversity combining in FIG. **7** can consist of cophasing, selective combining, Maximal Ratio combining or equal gain combining.

In FIG. **5**, L pilots are used to equalize the effects of the channel on each information-bearing data frame. The pilot frames can consist of Data frames of known information symbols to be sent either before, during or after the data, or of a number of samples of known values inserted within two transformations in FIG. **4**. A preferred embodiment of the pilots is to have the first pilot consisting of a number of frames of known information symbols. The remaining pilots can consist of a number of known information symbols between two transforms. The L estimators can consist of averaging of the pilots followed by either a parametric estimation or a nonparametric one similar to the channel estimator in the patent: "Method and Apparatus for Multiple Access between Transceivers in Wireless Communications using OFDM Spread Spectrum" by M. Fattouche and H. Zaghloul, filed in the U.S. Pat Office in Mar. 31, 1992, Ser. No. 07/861,725.

When Node A intends to transmit information to Node B, a preferred embodiment of a packet is illustrated in FIG. **12**: a Request frame **40**, an Address frame, an Ack. frame, a Pilot frame **36** and a number of Data frames **38**. The Request frame is used (1) as a wake-up call for all the receivers in the band, (2) for frame synchronization and (3) for packet synchronization. It can consist of a DSSS signal using one PN code repeated a number of times and ending with the same PN code with a negative polarity. FIGS. **13** and **14** illustrate the transmitter and the receiver for the Request frame respectively. In FIG. **14**, the dot product operation can be implemented as a correlator with either hard or soft decision (or equivalently as a filter matched to the PN code followed by a sample/hold circuit). The Request frame receiver is constantly generating a signal out of the correlator. When the signal is above a certain threshold using the level detector, (1) a wake-up call signal is conveyed to the portion of the receiver responsible for the Address frame and (2) the frames are synchronized to the wake-up call. The packet is then synchronized to the negative differential correlation between the last two PN codes in the Request frame using a decoder as shown in FIG. **14**.

The Address frame can consist of a CDMA signal where one out of a number of codes is used at a time. The code consists of a number of chips that indicate the destination address, the source address and/or the number of Data frames. FIGS. **15** and **16** illustrate the transmitter and the receiver for the Address frame respectively. Each receiver differentially detects the received Address frame, then correlates the outcome with it is own code. If the output of the correlator is above a certain threshold, the receiver instructs its transmitter to transmit an Ack. Otherwise, the receiver returns to its initial (idle) state.

The Ack. frame is a PN code reflecting the status of the receiver, i.e. whether it is busy or idle. When it is busy, Node A aborts its transmission and retries some time later. When it is idle, Node A proceeds with transmitting the Pilot frame and the Data frames. FIGS. **17** and **18** illustrate the transmitter and the receiver for the Address frame respectively.

An extension to the MC-DSSS modulation technique consists of passband modulation where the packet is up-converted from baseband to RF in the transmitter and later down-converted from RF to baseband in the receiver. Passband modulation can be implemented using IF sampling which consists of implementing quadrature modulation/demodulation in an intermediate Frequency between baseband and RF, digitally as shown in FIGS. **19** and **20** which illustrate the transmitter and the receiver respectively. IF sampling trades complexity of the analog RF components (at either the transmitter, the receiver or both) with complexity of the digital components. Furthermore, in passband systems carrier feed-through is often a problem implying that the transmitter has to ensure a zero dc component. Such a component reduces the usable bandwidth of the channel. In IF sampling the usable band of the channel does not include dc and therefore is the dc component is not a concern.

A further extension to the MC-DSSS modulation technique consists of using antenna Diversity in order to improve the Signal-to-Ratio level at the receiver. A preferred combining technique is maximal selection combining based on the level of the Request frame at the receiver.

We claim:

1. A transceiver for transmitting a first stream of data symbols, the transceiver comprising:

a converter for converting the first stream of data symbols into plural sets of N data symbols each;

first computing means for operating on the plural sets of N data symbols to produce modulated data symbols corresponding to an invertible randomized spreading of the first stream of data symbols; and

means to combine the modulated data symbols for transmission.

2. The transceiver of claim **1** in which the first computing means [includes] *comprises*:

a source of [N] *more than one and up to M* direct sequence spread spectrum [code symbols] *codes, where M is the number of chips per direct sequence spread spectrum code*; and

a modulator to modulate each [ith] data symbol from each set of [N] data symbols with [the ith] *a* code [symbol] from the [N code symbol] *up to M direct sequence spread spectrum codes* to generate [N] modulated data symbols, and thereby spread each [ith data symbol] *set of data symbols* over a separate code [symbol].

3. The transceiver of claim **2** in which the [code symbols] *direct sequence spread spectrum codes* are generated by operation of a non-trivial [N point] transform on a sequence of input signals.

4. The transceiver of claim **1** in which the first computing means [includes] *comprises*:

a transformer for operating on each set of N data symbols to generate [N] modulated data symbols as output, the [N] modulated data symbols corresponding to spreading of each [ith] data symbol over a separate code [symbol] *selected from a set of more than one and up to M codes, where M is the number of chips per code; and*

means to combine the modulated data symbols for transmission.

5. The transceiver of claim **4** in which the transformer effectively applies a first transform selected from the group [comprising] *consisting of* a Fourier transform and a Walsh transform to the N data symbols.

6. The transceiver of claim **5** in which the first transform is a Fourier transform and it is followed by a randomizing transform.

7. The transceiver of claim **6** in which the first transform is a Fourier transform and it is followed by a randomizing transform and a second transform selected from the group [comprising] *consisting of* a Fourier transform and a Walsh transform.

8. The transceiver of claim **4** in which the transformer effectively applies a first inverse transform selected from the group [comprising] *consisting of* a randomizer transform, a Fourier transform and a Walsh transform to the N data symbols, followed by a first equalizer and a second inverse transform selected from the group [comprising] *consisting of* a Fourier transform and a Walsh transform.

9. The transceiver of claim **8** in which the second transform is followed by a second equalizer.

10. The transceiver of claim **1** further [including] *comprising*:

means for receiving a sequence of modulated data symbols, the modulated data symbols having been generated by invertible randomized spreading of a second stream of data symbols; *and*

second computing means for operating on the sequence of modulated data symbols to produce an estimate of the second stream of data symbols.

11. The transceiver of claim **10** further [including] *comprising* means to apply diversity to the modulated data symbols before transmission, and means to combine received diversity signals.

12. The transceiver of claim **10** in which the second computing means [includes] *comprises*:

a correlator for correlating each [ith] modulated data symbol from the received sequence of modulated data symbols with [the ith code symbol] *a code* from [the] *a* set of [N code symbols] *more than one and up to M codes, where M is the number of chips per code*; and

a detector for detecting an estimate of the data symbols from output of the correlator.

13. The transceiver of claim **10** in which the second computing means [includes] *comprises* an inverse transformer for regenerating an estimate of the [N] data symbols.

14. The transceiver of claim **1** further [including] *comprising* a shaper for shaping the combined modulated data symbols for transmission.

15. The transceiver of claim **1** further [including] *comprising* means to apply diversity to the combined modulated data symbols before transmission.

16. The transceiver of claim **1** in which the [N] data symbols include a pilot frame and a number of data frames, and is preceded by a request frame, wherein the request frame is used to wake up receiving transceivers, synchronize reception of the [N] data symbols and convey protocol information.

17. A transceiver for transmitting a first stream of data symbols and receiving a second stream of data symbols, the transceiver comprising:

a converter for converting the first stream of data symbols into plural sets of N data symbols each;

first computing means for operating on the plural sets of N data symbols to produce sets of [N] modulated data symbols corresponding to an invertible randomized spreading of each set of N data symbols over [N code symbols] *more than one and up to M direct sequence spread spectrum codes*;

means to combine the modulated data symbols for transmission;

means for receiving a sequence of modulated data symbols, the modulated data symbols having been generated by an invertible randomized spreading of a second stream of data symbols over [N code symbols] *more than one and up to M direct sequence spread spectrum codes*;

second computing means for operating on the sequence of modulated data symbols to produce an estimate of the second stream of data symbols; and

means to combine output from the second computing means.

18. The transceiver of claim **17** in which the first computing means [includes] *comprises*:

a source of [N] *the* direct sequence spread spectrum [code symbols] *codes*; and

a modulator to modulate each [ith] data symbol from each set of N data symbols with [the ith code symbol] *a code* from the [N code symbol] *up to M direct sequence spread spectrum codes* to generate [N] modulated data symbols, and thereby spread each [ith] data symbol over a separate *direct sequence spread spectrum* code [symbol].

19. The transceiver of claim **18** in which the [code symbols] *direct sequence spread spectrum codes* are generated by operation of plural non-trivial [N point] transforms on a random sequence of input signals.

20. The transceiver of claim **17** in which the first computing means [includes] *comprises*:

a transformer for operating on each set of N data symbols to generate [N] modulated data symbols as output, the [N] modulated data symbols corresponding to spreading of each [ith] data symbol over a separate code [symbol].

21. The transceiver of claim **17** in which the second computing means [includes] *comprises*:

a correlator for correlating each [ith] modulated data symbol from the received sequence of modulated data symbols with [the ith code symbol] *a code* from the [set of N code symbols] *up to M direct sequence spread spectrum codes*; and

a detector for detecting an estimate of the data symbols from the output of the correlator.

22. The transceiver of claim **17** in which the second computing means [includes] *comprises* an inverse transformer for regenerating an estimate of the N data symbols.

23. A method of exchanging data streams between a plurality of transceivers, the method comprising the steps of:

converting a first stream of data symbols into plural sets of N data symbols each;

operating on the plural sets of N data symbols to produce modulated data symbols corresponding to a spreading of the first stream of data symbols over [N code symbols] *more than one and up to M direct sequence spread spectrum codes*;

combining the modulated data symbols for transmission; and

transmitting the modulated data symbols from a first transceiver at a time when no other of the plurality of transceivers is transmitting.

24. The method of claim **23** in which the spreading is an invertible randomized spreading and operating on the plural sets of N data symbols [includes] *comprises* modulating each [ith] data symbol from each set of N data symbols with [the ith code symbol] *a code* from the [N code symbols] *up to M direct sequence spread spectrum codes* to generate [N] modulated data symbols, and thereby spread each [ith] data symbol over a separate code [symbol].

25. The method of claim **23** in which the spreading is an invertible randomized spreading and operating on the plural sets of N data symbols [includes] *comprises*:

transforming, by application of a transform, each set of N data symbols to generate [N] modulated data symbols as output.

26. The method of claim **25** in which transforming each set of N data symbols [includes] *comprises* applying to each set of N data symbols a randomizing transform and a transform selected from the group [comprising] *consisting of* a Fourier transform and a Walsh transform.

27. The method of claim **25** in which transforming each set of N data symbols [includes] *comprises* applying to each set of N data symbols a Fourier transform, a randomizing transform and a transform selected from the group [comprising] *consisting of* a Fourier transform and a Walsh transform.

28. The method of claim **25** in which transforming each set of N data symbols [includes] *comprises* applying to each set of N data symbols a first transform selected from the group [comprising] *consisting of* a Fourier transform and a Walsh transform, a randomizing transform and a second transform selected from the group [comprising] *consisting of* a Fourier transform and a Walsh transform.

29. The method of claim **23** further [including] *comprising* the step of:

receiving, at a transceiver distinct from the first transceiver, the sequence of modulated data symbols; and

operating on the sequence of modulated data symbols to produce an estimate of the first stream of data symbols.

30. The method of claim **29** in which operating on the sequence of modulated data symbols [includes] *comprises* the steps of:

correlating each [ith] modulated data symbol from the received sequence of modulated data symbols with [the ith code symbol from the set of N code symbols] *a code from the up to M direct sequence spread spectrum codes*; and

detecting an estimate of the first stream of data symbols from output of the correlator.

31. The method of claim **23** further [including] *comprising the step of* shaping the modulated data symbols before transmission.

32. The method of claim **23** further [including] *comprising the step of* applying diversity to the modulated data symbols before transmission.

33. A transceiver for transmitting a first stream of data symbols, the transceiver comprising:

a converter for converting the first stream of data symbols into plural sets of data symbols each;

first computing means for operating on the plural sets of data symbols to produce modulated data symbols corresponding to an invertible randomized spreading of the first stream of data symbols over more than one and up to M direct sequence spread spectrum codes, where each direct sequence spread spectrum code has M chips; and

means to combine the modulated data symbols for transmission.

34. The transceiver of claim 33 further comprising:

means for receiving a sequence of modulated data symbols, the modulated data symbols having been generated by invertible randomized spreading of a second stream of data symbols; and

second computing means for operating on the sequence of modulated data symbols to produce an estimate of the second stream of data symbols.

35. The transceiver of claim 34 further comprising means to apply diversity to the modulated data symbols before transmission, and means to combine received diversity signals.

36. The transceiver of claim 34 in which the second computing means comprises:

a correlator for correlating each modulated data symbol from the received sequence of modulated data symbols with a code from the set of up to M direct sequence spread spectrum codes; and

a detector for detecting an estimate of the data symbols from output of the correlator.

37. The transceiver of claim 34 in which the second computing means comprises an inverse transformer for regenerating an estimate of the data symbols.

38. The transceiver of claim 33 further comprising a shaper for shaping the combined modulated data symbols for transmission.

39. The transceiver of claim 33 further comprising means to apply diversity to the combined modulated data symbols before transmission.

40. The transceiver of claim 33 in which the data symbols include a pilot frame and a number of data frames, and is preceded by a request frame, wherein the request frame is used to wake up receiving transceivers, synchronize reception of the data symbols and convey protocol information.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : RE 37,802 E
DATED : July 23, 2002
INVENTOR(S) : M.T. Fattouche et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Title page,
Item [63], **Related U.S. Application Data**, insert in appropriate order

-- **Related U.S. Application Data**
[63] Continuation-in-part of U.S. application No. 07/861,725, filed on Mar. 31, 1992, now Pat. No. 5,282,222 --

Signed and Sealed this

Eleventh Day of March, 2003

JAMES E. ROGAN
Director of the United States Patent and Trademark Office

CERTIFICATE OF SERVICE

I hereby certify that on this 29th day of August, 2014, I electronically filed the confidential and non-confidential versions of the Opening Brief for Plaintiff-Appellant Wi-LAN Inc., with the Clerk of the Court using the CM/ECF System, which will serve via email notice of filing to all counsel registered as CM/ECF users. In addition, I will serve the following counsel via email with copies of the confidential brief:

Mark C. Scarsi (Lead Counsel)
Milbank, Tweed, Handley & McCloy LLP
mscarsi@milbank.com

Miguel Ruiz
Milbank, Tweed, Handley & McCloy LLP
mruiz@milbank.com

Ashlee Lin
Milbank, Tweed, Handley & McCloy LLP
ashlee.lin@milbank.com

Upon acceptance by the Court of the e-filed document, six paper confidential copies will be filed with the Court, via Federal Express, and two paper confidential copies will be served, via Federal Express, to the above listed counsel within the time provided in the Court's rules.

Respectfully submitted,

By: /s/ Robert A. Cote___________
Robert A. Cote
Attorney for Plaintiff-Appellant
Wi-LAN Inc.

CERTIFICATE OF COMPLIANCE

I certify that the foregoing CONFIDENTIAL OPENING BRIEF FOR PLAINTIFF-APPELLANT WI-LAN INC.:

1. Complies with the type-volume limitation of Fed. R. App. P. 32(a)(7)(B). This brief contains 13,701 words, excluding the parts of the brief exempted by Fed. R. App. P. 32(a)(7)(B)(iii) and Fed. Cir. R. 32(b). Microsoft Office 2010 (With Windows 7) was used to calculate the word count; and

2. Complies with the typeface requirements of Fed. R. App. P. 32(a)(5) and the type style requirements of Fed. R. App. P. 32(a)(6). This brief has been prepared in proportionally-spaced typeface using Microsoft Office 2010 (With Windows 7) in 14-point Times New Roman type style.

Dated: August 29, 2014.

Respectfully submitted,

/s/ Robert A. Cote

Robert A. Cote
MCKOOL SMITH P.C.
1 Bryant Park
New York, NY 10036
(212) 402-9402
Attorney for Plaintiff-Appellant

McKool 1012745v3